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ABSTRACT

A group of partners headed by the Home Builders Institute (HBI) created the Mid-Atlantic Regional Training (MART) Center for Residential Construction, with a primary focus on providing education and training services related to the masonry and carpentry trades at existing institutions in the District of Columbia, Maryland, Virginia, and West Virginia. The center provided training and support services to 263 persons and numerous residential construction companies in these states. An evaluation of the program showed that the center was particularly successful in recruiting minorities (almost 50 percent were African American compared to 5 percent of carpenters nationwide) and women (about 10 percent, compared to 1 percent of carpenters nationwide). Two 26-week worksite-based training sessions were held. Worksite instruction involved framing homes under contract with local builders. The center was successful in creating partnerships with local builders and the industry and leveraging private and public resources. The regional center approach attracted the attention of national companies and made project cooperation easier. Students were offered such services as transportation, job placement and career counseling and were given basic tools. Ninety-nine percent (113) of the persons who graduated from MART obtained jobs in the construction industry, with older workers more likely to graduate from the program. In addition, the program developed skills standards for 89 carpenter framer tasks. The program evaluation determined that MART met or exceeded its objectives and that such a center is an extremely effective approach to training workers. (Appendices include a carpenter framer questionnaire, duties, and tasks and the MART performance tests.) (KC)

ED 375 245

Mid-Atlantic Regional Training Center for Residential Construction Trades
Grant No.V199C10028

FINAL PROGRAM EVALUATION REPORT
Submitted December 31, 1993

by

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PART I: INTRODUCTION AND CONCLUSIONS

Chapter 1

THE PROSPECTS OF CREATING NEW TRAINING OPPORTUNITIES AND LEVERAGING RESOURCES THROUGH A MID-ATLANTIC REGIONAL TRAINING CENTER (MART)

The Home Builders Institute (HBI), the educational arm of the National Association of Home Builders (NAHB) and PAVE, the Education and Training Foundation , in collaboration with the Brick Institute of America (BIA) were funded under the Cooperative Demonstration Grant Program authorized under the Carl Perkins Act to establish a partnership to implement a Mid-Atlantic Regional Training Center for Residential Construction, with a primary focus on providing education and training services related to the masonry and carpentry trades. The Regional Training Center, designed as a multiple campus, centrally administered program, offered services at existing institutions in the District of Columbia, Maryland, Virginia and West Virginia. The Center provided training and support services to 263 individuals and numerous residential construction employers through these states. State and local home builders associations, together with the Masonry Institute also cooperated in the planning, implementation and operation of the Regional Training Center.

HBI was the prime contractor and the liaison to the residential construction industry and coordinated all activities of builders in the region involved in the planning and implementation of the Regional Center. Also, HBI project staff modified the carpentry framing and masonry curricula used in project as well as developed skill standards and the carpenter framer performance certification test. PAVE was the liaison for the region's education community and supervised each sites' coordinator.

The Center served 263 individuals throughout the region for masonry and carpentry framing training, worker upgrading and retraining and specialized workshop instruction for subcontractors. Both youth and young adults were served during the project. Worksite and classroom training was provided in carpentry framing, masonry and trowel trades of bricklaying. Building and apartment maintenance skills were taught to Department of Public Housing workers in the District of Columbia. Two, 26 week eight hours a day worksite-based training sessions were held at MART sites in the District of Columbia, Maryland and Virginia. West Virginia participated in only one 26 week training session. All worksite instruction involved framing homes under contract with local builders. Local builders made time allowances based on size and complexity of the framing job to offset the use of MART trainees. During the 21 month contract term MART students participanted in framing 11 homes.

Strategically, the Center combined the advantages of a centrally administered, multi-campus program with worksite learning developed under HBI's and PAVE's Industry Education Alliance program. The Alliance program features a seamless partnership between the home building industry and educational providers. The Center conducted survey with local employers in the region to match up labor market demands and training needs. Also, the Center worked with its local educational partners to modify their existing delivery system so that they could be better able tailored to meet these needs.

Services offered by the Center included; skill training, career assessment, planning and counseling as well as social and support services such as financial assistance, housing, child care and tools and equipment. In-service training to the instructional, administrative, and counseling of the cooperating educational institutions was also provided. A building trades resource directory including a building trades video library and a management information system was developed through this grant.

The Regional Training Center addressed the need for assessment through the development and content validation of a sample carpenter framer criterion-referenced performance test. In addition, skill standards that describe the level of job performance were developed and validated using both judgmental and empirical approaches. Carpentry framers and framing subcontractors (subject matter experts) were extensively involved in the development and validation process. The Center also, modified existing curriculum carpentry framing and masonry trades.

Partners Roles

The premise underlying the regional concept of MART is that the public sector educational institutions and private sector residential home builders are able to provide a greater range of high quality services to the home building industry rather than any single public institution or private organization. The role of educational partners in MART is as follows:

- Inventory vocational education programs make modifications as required as well as work with local employers to consider strategies about future training needs.
- Provide recruitment, enrollment and assessment of students.
- Provide required support services.
- Provide competency carpentry framing and masonry training.
- Provide basic skills remediation as well as continuing education for journey persons, subcontractors and builders.

The roles of industry partners in MART are to:

- Asses the need for skilled workers in the residential construction industry, evaluate the effectiveness of local training programs and identify changes to curricula to better meet workforce demands.
- Assist in the development of carpenter framer skill standards.
- Assist in the recruitment and selection of MART students.
- Contribute to the student scholarship fund.
- Provide student job sites for worksite training.
- Assist with placement and post-graduation follow-up

MART Objectives

Pursuant to Grant Application # V199C10028 the following objectives are listed:

- To establish the Mid-Atlantic Regional Training Center for the masonry and other building trades.
- To develop or modify competency-based instruction and testing materials that meet the standards of the residential construction industry.
- To implement effective outreach, promotion, recruitment, and student services for the Regional Center.
- To provide education and training for 240 students in the building trades with priority for training given to the masonry trades.

In preparing the *MART Final Evaluation Report* the evaluator has looked at (1) the ability of MART to create an alliance between employers and educators; (2) the ability of the Center to leverage private and public resources to keep the program operational once Federal funding is withdrawn; (3) what the benefits are of a centrally coordinated, multiple campus training center; (4) the scope and nature of services offered by MART; (5) the characteristics of MART participants especially as they related to minority and special populations; (6) placement results in related and non-related jobs; (7) what factors seem to impact participant outcomes; (8) whether the standards and performance test developed meet professional certification test standards; and (9) the challenges facing a regional training strategy.

The findings of the MART project are summarized as follows:

Industry-Education Alliances

MART created industry-education alliances in the District of Columbia, Frederick, Maryland, Richmond, Virginia and Martinsburg, West Virginia. The table below shows the respective industry and education partners at each site:

Table 1-1
MART
Industry-Education Alliance Partners

Industry Partner	Education Partner
District of Columbia Building Industry Association	Armstrong Adult Education Center
Frederick County Builders Association (Maryland)	Hagerstown Junior College
Home Builders Association of Richmond (Virginia)	High Springs Technical Center
Eastern Panhandle Home Builders Association (Martinsburg, West Virginia)	James Rumsey Technical Institute
Northern Virginia Building Industry Association	Northern Virginia Community College

Armstrong Adult Education Center conducted two, 26 week training programs in building and apartment maintenance, Hagerstown Junior College conducted two, 26 week programs in carpentry framing and one 26 week program in masonry, High Springs Technical Center operated two 26 week programs in carpentry training and the James Rumsey Technical Institute conducted one 26 training program each in carpentry framing and masonry. All training programs operated 8 hours per day, five days a week and included worksite trade as well as related academic instruction. The full range of support services including transportation, child care and etc. . . were provided at each site. The Northern Virginia Community College MART site was set up in late Septemeber 1993 and was not fully operational as of the end of the grant period.

MART sites in the District of Columbia, Virginia and Maryland have decided to continue the operation of training programs developed under this grant without the use of federal funding. Hagerstown Junior College has elected to operate the program without the management assistance of the Alliance partners, HBI and PAVE. The District of Columbia and the High Springs Technical Center have agreed to work with HBI and PAVE and other Alliance programs managed by both organizations. The James Rumsey Technical Institute has decided not to continue the operation of their program.

Leveraging Private and Public Resources

The Center generated $426,949 in public and private resources as the result of aggressive marketing of the benefits of the Regional Center to national corporate and local educational partners. Corporate partners donated approximately $139,000 in materials, supplies and tools and equipment to MART

sites in Richmond, Virginia and Frederick, Maryland. Corporate donations ranged from windows to brick to kitchen appliances and more. Local education partners donated $287,949 in direct support to the project. The breakdown by individual site is as follows: Maryland $47,500; Virginia $93,073; West Virginia $73,876; and the District of Columbia $73,500 to continue the program. Interestingly, only about 3% of contributions by educational institutions were in-kind.

In addition, local builders provided many hours of free time in serving on Builders Coalitions and arranging for MART job sites. Many national manufacturers conducted product training seminars at participating sites

What are the Benefits of a Centrally Coordinated, Multiple Campus Training Center?

One of the obvious benefits is the ability of the Regional Center concept to attract the attention of large, home building products corporation willing to donate products to regionally organized training programs. It is unlikely that a stand-alone educational institution could leverage the magnitude of the resources generated by itself. Also, central coordination seemed to enhance the sharing of labor market, curriculum, placement and other information as well as the potential for cost savings in making purchases.

What Services Were Offered?

All sites offered an impressive array of services including transportation, career counseling, academic remediation, job placement child care and others, in addition to job training. However, as of the result of the mix of MART student characteristics discussed later in this chapter the use of student services in addition to job training were: (a) transportation to the worksite; (b) job placement; and career counseling. Although not a service per se, all graduates were provided with a free tool box and a basic set of tools for house framing. As the result of weekly progress reviews by MART instructors most students also were given a DeWalt power saw. Home builders associations provided a ten dollar per day cash scholarship to all MART participants.

What Were the Significant Characteristics of MART Students?

Minority populations represented 54% of the students enrolled in MART sponsored programs. Fifty percent were African American, 46% were white and the remainder representatives of other than African American minority populations.

Ninety percent were males and ten percent were females. MART recruitment and outreach efforts appeared to be particularly effective in that based on a

recent article in the *Employment and Earnings Journal*, January 1993 nationwide females make up only 1% of carpenters and African Americans only 5.4%. The level of education attained by MART students ranged from twenty-five percent with less than a high school diploma to seven percent with a 2 year or 4-year college degree. Fifty-four percent had a high school diploma or GED. MART attracted and served a population that represented a broad spectrum of educational attainment.

Almost eighty percent of MART participants had no prior experience in related training (e.g. carpentry, roofing; plumbing and so on) and only five percent reported taking a vocational education program.

The Center served a young adult and adult population with about one third (31%) of those served in the age range 25 to 34, twenty-seven percent between 35 and 44 years of age, twenty-three percent 28 to 44 yeas of age and nineteen percent over 44 years of age.

What is the Job Market for MART Graduates?

More than forty percent (43%) of MART students graduated the various training programs, thirty-four percent remain in training twenty-three percent dropped out. Ninety-nine percent (N = 113) of those who graduated from MART were employed in the construction industry. However, ninety-four percent (N = 18) of those dropped out of MART but were employed, were employed in non-related jobs. Literally all MART graduates were placed or were already working in the residential home construction industry or trades related to construction.

What Factors Impact Participant Outcomes?

Preliminary analyses indicate that gender and ethnicity are not significantly related to MART outcomes (i.e. dropping out, graduating or in training) >p0.05. Males, females, and other members of minority groups appear to perform equally well in Center's programs. However, age and prior participation in a related training program are related to outcomes; significant at the .05 level. More mature students appear to graduate at a proportionally higher rate than younger students. Also, prior related training is a good predictor of graduating training; significant at the .05 level.

Skills Standards and Performance Test Development

Center staff developed skills standards for 89 individual carpenter framer tasks. Subject matter experts (carpenter framers and framing subcontractors) were widely used in the development and validation of the standards. These standards were the basis for the development and validation of a criterion-referenced mastery performance-test for certifying carpenter framers. Content

validity was determined through the use of a survey of carpenter framers and framing subcontractors as well as a second review by a different panel of subject matter experts. The performance test includes five sub-test covering tasks determined by the survey as being important and performed frequently by carpenter framers. A pre-test administration was conducted using a sample of (N = 39) qualified and non-qualified carpenter framers. Inter-rater reliability was estimated at about 100% and preliminary empirical data suggest that the test can discriminate between qualified and non-qualified carpenter framers. The test results are judged to meet the basis testing industry standards for certification.

Conclusions

Based on the evaluation findings the following conclusions are in order:

1. The Mid-Atlantic Regional Center met and/or exceeded the basic objectives contained in the grant application with respect to: (a) the establishment of a Regional Training Center; (b) the development of employer based curriculum, skills standards and testing materials; (c) the implementation of effective outreach, recruitment and student activities and services; and (d) the provision of providing education and training to at least 240 students in the building trades.

2. The Center concept is an extremely effective approach for leveraging financial, material and other resources in support of residential construction training. National corporations serving the residential construction industry are more attracted to serving a wider, regional market than stand-alone local programs and educational institutions. Also, the advantage of a centrally administered program serving several institutions makes it possible for national corporations to deal with a single rather than many project directors.

3. The Center's outreach and recruitment methods were very effective in attracting females and representatives of minority populations the training programs. Because of the paucity of female and African American among other minority representatives in our nation's workforce of carpenters the multiple strategies used in this project to attract representatives of these groups should be expanded to all vocational and other job training programs that provide skill training.

4. It is simply not sufficient to adopt a pro-training approach: barriers that prevent special populations from receiving training and getting and keeping jobs must be addressed. These include discrimination by sex, race, and by national origin, low educational achievement, inadequate access to information about training and jobs and transportation difficulties, The multiply services approach

used by MART should be required in all training programs that serve special populations.

5. The ability of the program and curriculum to yield comparable outcomes without respect to gender and ethnicity should be considered for adaptation by all training programs serving representatives of special populations.

6. The Regional Center approach appears to be very effective. Three of the four sites involved in the demonstration grant have continued the operation of the program without Federal support.

7. The skills standards and carpenter certification model meet the basic testing-industry standards and requirements for occupational tests. Although the example used in this project is specific by design to the home construction industry the basic approach and elements should be able to be applied across all skill training programs.

PART II: FINDINGS

Chapter 2

EFFICACY OF AN INDUSTRY-EDUCATION ALLIANCE

Creation of an Alliance Between Employers and Education

Alliance Model. The Mid-Atlantic Regional Training Center (MART) was a training program designed to serve Virginia, West Virginia, Maryland and the District of Columbia residential construction industry. Builders, subcontractors, remodelers and educators form partnerships to train skill-workers in several trades including masonry and related trowel trades, carpentry framing and building and apartment maintenance (BAM). MART provided educational seminars and work-based training programs for youth and adults. MART is based on the Industry-Education Alliance Model, currently operating in other cities in the United States.

The Alliance Model includes as its major elements the following:

- The use of educational institutions to provide qualified instructors, classroom and shop facilities and transportation to and from local worksites. Also, they provided accreditation of facilities and programs being conducted and basic skills remediation as required by MART students on a one-to-one basis.

- The development of an Employer Coalition of major employers in each Home Builders Association (HBA) for the purpose of identifying the training needs and levels of skill to which students will be trained as well as subcraft skills areas in which training is required at the skilled workers level.

- Assessment of the need for short-term seminar type of courses in specific field which would be of interest to subcontractors.

- The use of home builders associated with HBAs to assist in recruitment, job placement within their local communities and provide general input and guidance in defining educational and skills levels. Also, provide student job sites, assist with post-graduation employment and job placement activities, and contribute to student scholarship funds.

MART expanded and enhanced the Alliance Model to meet the residential construction needs in the following ways:

- Organized training to mesh with the labor market skill needs as well as of local home builders in the Mid-Atlantic region; i.e. on time training.

- Training was made available on a regional basis (the Mid-Atlantic states of Virginia, West Virginia, District of Columbia and Maryland). MART students could cross state boundaries without paying out of state tuition.

- Development of standards and a process for certification of which will inform employers of the skill level held by a job candidate prior to hiring.

Partners Roles and Relationships. The Home Builders Institute (HBI) was the prime contractor and PAVE, the Education and Training Foundation the subcontractor for the subject grant.

- HBI served as liaison to the residential construction industry and coordinated activities of builders in the region involved in the planning implementation of the Regional Center. Also, they assessed builder needs for training in the region, prepared curricula, developed carpenter framer standards and organized all promotional activities.

- PAVE served as the liaison to the educational community and worked with schools in the development and implementation of training programs and coordinated all worksite training and construction activities.

The Brick Institute of America (BIA) was the liaison to brick manufacturers, advised on curriculum and provided brick training materials at no cost to the Regional Center. The National Association of State Directors of Vocation played a minor role in disseminating information about the Regional Center to state education agencies. The Masonry Institute reviewed masonry curricula and advised on "best practices" for training.

Educational Partners. The following is a list of educational partners participating in the MART project:

Armstrong Adult Education Center	District of Columbia
Hagerstown Junior College	Frederick, Maryland
High Springs Technical Center	Richmond, Virginia
James Rumsey Technical Institute	Martinsburg, West Virginia

Carroll County Vocational Technical Center cooperating with the Carroll County Community College in central Maryland had been proposed as the site but was unable to meet the financial rrequirements of MART.The Carroll County site was replaced by Hagerstown Junior College.

Trade Training. Skill training was originally proposed in the following trades: Masonry Restoration; Bricklaying; Stucco; Cement Masonry; Remodeling/Historic Restoration; Carpentry; Plumbing and Electrical trades. As the result of meetings conducted by HBI staff with representatives of the above mentioned home builders coalition with respect to labor market demands the decision was made to shift MART's training emphasis from masonry to include construction and building and apartment maintenance.

Masonry training was offered in Maryland and West Virginia. Carpentry framing training was offered at MART sites in Maryland, West Virginia and Virginia. The District of Columbia was the only site that offered building and apartment maintenance (BAM) training.

Training lasted 26 weeks at each of the above sites. The following is the number of training cycles held at each of the MART locations:

	MASONRY	BUILDING AND APARTMENT MAINTENANCE	CARPENTER FRAMER
DISTRICT COLUMBIA		2	
MARYLAND	2		2
VIRGINIA	1		2
WEST VIRGINIA			1

MART sites which offered two cycles continue to have students in training as of October 30, 1993. These sites will complete the 26 week training period at no cost to the Federal government using funds generated by the Alliance, PAVE and HBI.

Seminars. As part of MART's strategy for upgrading skilled residential construction it conducted one and two day seminars. The following is a sample list of seminars conducted:

- Glass Block and Glazed Tile
- Modular Fireplaces
- Brick Paving

Most of the seminars were directed at journey person masons.

MART's Ability to Leverage Industry Resources

Corporate partners donated building materials and supplies, appliances, power tools other items used in the construction of scholarship homes estimated at $139,000. Scholarship homes are residences framed by MART students in the carpenter framing program the proceeds of the sale of which goes into supporting MART. One scholarship homes each were built in Virginia and

Maryland. The homes had a market value between $200,000 and $235,000. Local home builders participating in MART sponsored the scholarship homes and completed all the construction and masonry with the exception of framing which was done by MART students.

Table 2-1
Value of Corporate
Partners Materials Donations

	CORPORATE PARTNERS MATERIALS DONATIONS *VALUE*
RICHMOND, VA	$73,500.00
FREDERICK, MD	$65,500.00
TOTAL	$139,000.00

A partial list of items donated by national corporate partners appears below. A complete list of corporate partners and donations is found in the final project report.

Corporate Partner	**Item Donated**
Andersen Windows	Windows
Armstrong World Industries	Ceramic Tile & Vinyl Flooring
DeWalt	Power Tools
Cobra Ventilation, Inc.	Ridge Vent
Dupont	Tyvek House Wrap
Frigidaire	Kitchen Appliances
Lowes	Framing Lumber @ cost
Moen	Plumbing Hardware
Redland Brick	Brick
Stanley Bostich	Pneumatic nail system
Trus Joist MacMillen	Floor trusses & paralams
Velus-Ameraican, Inc.	Skylights
Pittsburgh Corning	Glass Black

Education's Contribution to Training

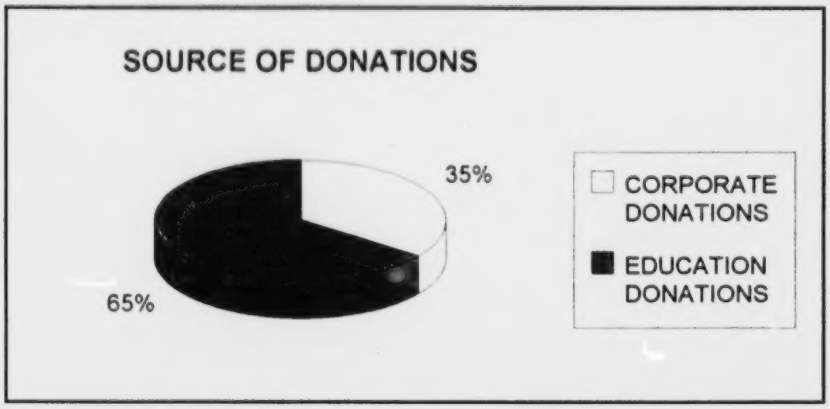
MART sites in Maryland, District of Columbia, West Virginia and Virginia contributed an estimated $287,949 to the project as shown in Table 4-2. This figure is adjusted for direct funds received these sites. (See Table 2-2 for details). Virginia contributed $93,073, West Virginia $73,876, District of Columbia $73,500 and Maryland $47,5000. The vast majority of contributions were for expenditures related to training delivery costs, followed by ancillary services and last, indirect expenses.

Table 2-2
Education's Contribution to the Regional Training Center

	MARYLAND	*VIRGINIA*	*W. VIRGINIA*	*DISTRICT COLUMBIA*	
TRAINING DELIVERY COSTS:					
Instructor Salaries	$60,800	$40,681	$19,500	$45,500	$166,481
Material Purchases	$11,500	$6,000	$10,000	$2,500	$30,000
Equipment Leases	$2,750		$5,000		$7,750
Supply Purchases	$1,500	$5,000	$2,500	$1,750	$10,750
Classroom Overhead	$12,000	$18,000	$12,000	$18,000	$60,000
Student Transportation		$8,000	$6,000		$14,000
Promotional Video		$2,500			$2,500
Student Textbooks	$950		$900	$950	$2,800
Sub-Total	$89,500	$80,181	$55,900	$68,700	$294,281
ANCILLARY SERVICES:					
Staff Salaries	in-kind	$6,068	$9,900	$4,800	$20,768
Staff Travel	in-kind	$2,000	$2,500		$4,500
Printing	in-kind	$2,000	$1,500		$3,500
Sub-Total		$10,068	$13,900	$4,800	$28,768
INDIRECT		$2,824	$4,076		$6,900
(GRANT)	($42,000)				($42,000)
GRAND TOTAL	$47,500	$93,073	$73,876	$73,500	$287,949

The total value of resources generated by MART is estimated to be $426,949. Thirty-five percent of the estimated value of the resources were generated by national corporate partners and sixty-five percent by four educational partners.

Chart 2-1
Sources of Resources
Generated by Regional Center



Cooperating Home Builders Associations

- District of Columbia Building Industry Association
- Home Builders Association of Maryland
- Home Builders Association of Richmond
- Frederick County Builders Association
- Eastern Panhandle Home Builders Association
- Suburban Maryland Building Industry Association

Construction Projects

The following is a list of on site training projects conducted by MART along with the sponsoring industry partner:

DISTRICT COLULMBIA	BUILDING AND APARTMENT MAINTENACE	PARTNER
	Montana Housing Complex - Section #8 Housing Unit 2- Complete total renovations • 1 - 6 Bedroom Unit • 1 - 4 Bedroom Unit	
MARYLAND	**CARPENTER FRAMER**	
	3000 Sq. Ft. Frame of custom house	Cordell Construction
	2700 Sq. Ft. Frame of custom house	Cordell Construction
	2400 Sq. Ft. Frame of custom house	Ausherman Construction
	2700 Sq. Ft. Frame of custom House	Frederick County Home Builders Associaton*

MARYLAND CON'T.	**MASONRY**	
	500 Sq. Ft. Block Foundation	Cordell Construction
	1288 Sq. Ft. Block Foundation	Frederick County Home Builders Association*
WEST VIRGINIA	**CARPENTER FRAMER**	
	3000 Sq. Ft. Frame of custom house	Berkley Builders
	3200 Sq. Ft. Frame of custom house	Berkley Builders
	950 Sq. Ft. Frame of custom house	Voelker Construction
	2200 Sq. Ft. Frame of custom house	Clevenger Homes
	MASONRY	
	2 - 4Ft. x 24Ft. Walls	Rumsey Technical Inst.
VIRGINIA	**CARPENTER FRAMER**	
	1800 Sq. Ft. Frame of custom house	Richmond Homes
	2800 Sq. Ft. Frame of custom house	Mike Dumont Homes
	1400 Sq. Ft. Frame of track house	Parker Lancaster Corp.
	12 x 24 Treated wood deck	Boone, Boone & Petit
	MASONRY	
	1200 Sq. Ft. Block Foundation	Home Buuilders Associaton of Richmond*
PAVERS	14 X 30 Ft. Patio	Henrico County Government Center
	14 x 32 Ft. Patio	Carroll County Communty College

Scholarship homes are designated with an asterik.

Chapter 3

EFFECTIVENESS OF A CENTRALLY COORDINATED REGIONAL TRAINING CENTER

Students Served

MART served 263 students during the course of the 21 month project; (The project received a three month "no cost extension" extending the project from 18 to 21 months.) During contract negotiations MART's projected number of students to be served was reduced from 400 to 240 students. MART exceeded the number to be served by 23 students or about 10% as shown in Table 3-1 below.

Table 3-1
MART Students Served

	OUTCOME				
	DROPPED	*GRADUATED*	*IN TRAINING*	*Grand total*	*Percent*
DISTRICT COLUMBIA	9	35	65	109	41%
MARYLAND	11	21	14	46	17%
PAVERS	0	26	0	26	10%
VIRGINIA	29	23	10	62	24%
W. VIRGINIA	11	9	0	20	8%
Grand total	60	114	89	263	
PERCENT	23%	43%	34%		

Thirty-four percent of the total number served are still in the second cycle of the 26 week training program as of October 30, 1993. Costs for the training are being paid for by a variety of sources including the sale of scholarship homes, revenue generated through framing houses, donations and in-kind contributions by local Home Builder Associations, national corporate partners and local educational institutions.

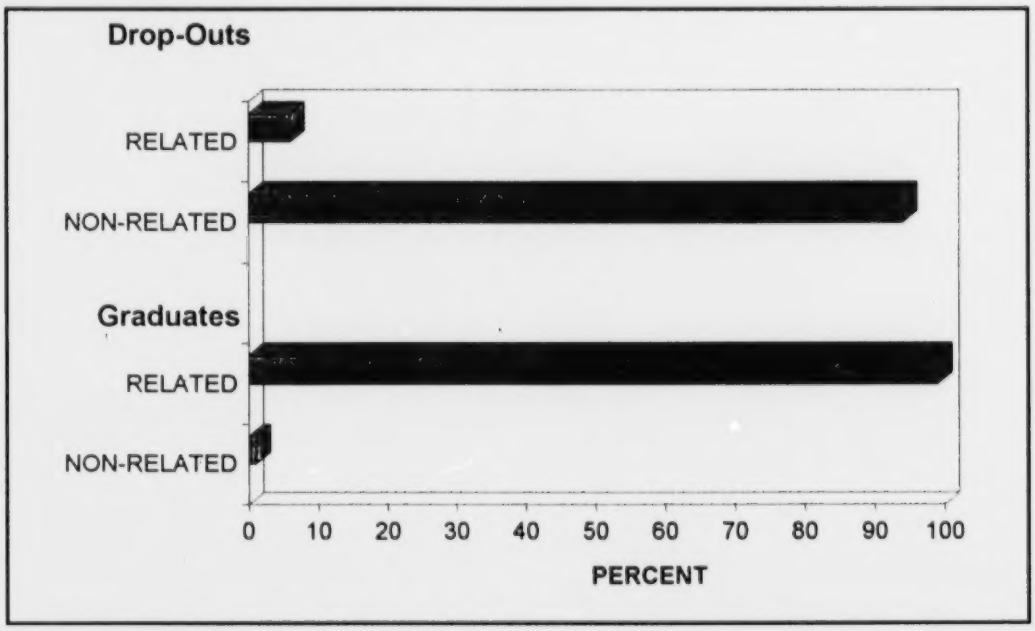
Approximately all students (99%) graduating from MART training programs were employed in construction related jobs as shown in the chart below. On the other hand, 94% of those participants dropping out of MART training were employed in non-related jobs. These figures are based on a total number of 131 participants who dropped out (18) or graduated (113) from MART and were employed as of October 31, 1993. (See Table 4-8 for details.)

Participant Outreach, Promotion, Recruitment and Student Services

A broad array of outreach, promotion and recruitment activities were undertaken by MART as part of recruitment as well as to generate support from local home

builders, Home Builders Associations, and local educational institutions. Strategically these activities were designed to gain support for MART from the residential construction industry, educational institutions and the general public.

Chart 3-1
Relationship Between
Graduates, Drop-Outs and Employment



Activities included promotional advertising, newspaper articles, recruitment flyers, radio P.S.A (Public Service Announcement) and TV commercials. A partial list include:

- *Metro Real Estate* Magazine, Richmond, VA
- *The Henrico Gazette*, Richmond, VA
- *Richmond Time Dispatch*, Richmond, VA
- *Footings,* Home Builder Association of Richmond Magazine
- *The Morning Journal*, Martinsburg, WV
- *BAI News*, Brick Institute of America Magazine
- *Builder Bulletin*, Newsletter of Frederick County Builders Association
- *The Frederick News Post*, Frederick MD
- *The Morning Herald* Tri State, Hagerstown, MD
- *School Board News*, National School Boards Association
- *Brick News,* National Association of Brick Distributor
- WYNN-TV Fox Network, Martinsburg, WV
- WHAG-TV NBC Hagerstown, MD
- Frederick Cable Vision

Also, PAVE installed an 800 phone number to encourage inquiries about MART. All students were interviewed by each sites local coordinator and a local builder as part of the intake process. Students were administered the TABE and if need basic skills academic instruction was provided by the local educational partner participating in MART. Financial Aid forms (e.g. Pell Grant Applications) were available for student use.

After students completed and graduated training they were given job counseling and job placement services by MART staff. Most placements were made with local framing contractors at each of the MART sites. If needed, transportation, child care and other social services were made available to students through referrals to local social agencies.

Video Library

MART staff ordered and previewed over 100 instructional video tapes. In additional, leading corporate manufacturers were solicited for installation (i.e. video tapes that explain how to install specific manufacturer products) and/or instructional videos. MART developed a *Building Trades Video Library* which was distributed to MART educational staff in December 1992.

A *Building Trade Instructional Resource Library* was subsequently developed by MART that included the above video library. This document was released to project staff in the late Winter 1993. The contents of the *Resource Library* are organized by title, publisher and run time. Major headings for the Resource Library are as follows:

- Video
- Textbooks and Manuals
- Product Literature
- Wall Charts
- Kits
- Software
- Test Item Banks

A copy of the *Building Trades Instructional Resource Library* is found in the *MART Project Final Report*.

Staff Liaison and Development

Instructors and site coordinators attended three Instructor/Campus Coordinator Conferences in Washington, DC at about six month intervals for the purpose of communicating any changes in MART's strategies as well as sharing of information across all sites. Specific topics included curriculum, training methods, student assessments, progress in meeting goals and job placement.

Monthly staff meetings were held between site coordinators and the PAVE project director. Orientation sessions were conducted by MART site coordinators for all local educational staff involved as well as local home builders participating in the project.

Managing Information

PAVE developed and implemented a data base management information system (MIS) for the management of participant records. PAVE staff updated the system about biweekly and provided HBI project staff as well as local site administrators with periodic reports. Also, the data contained in the MIS was used by the third-party evaluator in preparing the MART *Final Evaluation Report.*

Basic Academic Skills

Results of assessments conducted during the intake sessions were used as a basis for basic academic skills remediation. For the most part remediation consisted of instruction provided at the worksite since all of the 263 participants had achieved a GED or higher. However, many students who obtained a GED, high school diploma and even some college level courses required instruction in how to measure and compute with fractions. If needed, students could receive basic skills instruction at each of the sites local educational partner. Instruction in applied fractions and measuring skills was judged by instructors to be most effective when provided at the worksite.

Industry Based Curriculum

As the result of meetings with local home builders coalitions at each of the sites, a decision was made by project management to shift MART's curriculum emphasis from the masonry and trowel trades to the sub-craft carpentry framing. Although an earlier survey of 57 home builders and masons indicated a strong need for masons and related sub-crafts local construction employers in Richmond, VA, Martinsburg, WV, Frederick, MD and Washington, DC area indicated a greater need for carpenter framers.

HBI modified existing carpenter framing curriculum for the project. A curriculum specialist at HBI was responsible for this activity as well as the review of the masonry curriculum used Richmond, VA and Frederick, MD.

Chapter 4

THE OPPORTUNITY OFFERED BY MART

Characteristics of MART Participants

Gender. Ninety percent (90%) of MART participants were males and 10% were females. According to the January 1993 *Employment and Earnings Journal,* published by the Bureau of Labor Standards, males dominant 99% of the carpenter work force in the United States. Only 1.0% of the workforce reported in this article were female. The lowest percentage of females was in Maryland with 7% female participation reported.

Table 4-1
Percentage of Mart Participants by Gender

	GENDER		
	FEMALE	*MALE*	*Grand total*
DISTRICT COLUMBIA	10	99	109
VIRGINIA	6	56	62
MARYLAND	3	43	46
PAVERS	6	20	26
W. VIRGINIA	3	17	20
Grand total	28	235	263
PERCENT	10%	90%	

Ethnicity. Half of the MART participants were African American and slightly less than half (46%) were white. The remaining four percent were Hispanic (1%), Asian (1%) and two percent reported other. As reported in the above Journal article slightly more than five percent (5.4%) of the carpenter workforce in the nation is African American. MART programs in the District of Columbia and Virginia reported 100% and 40% African American enrollment respectively.

Age. About one third (31%) of the participants were in the age range 25 to 34, twenty-seven percent between 35 and 44 years of age, twenty-three percent 28 to 44 years of age and nineteen percent more than 44 years of age. Maryland, Virginia and West Virginia had proportionally more younger participants than the District of Columbia. This was the result of two Alliance sites partnership with secondary vocational education programs (Highland Springs Technical Center, Richmond VA and James Rumsey Vocational-Technical School, Martinsburg WV) and Maryland's partnership with Carroll County Vocational Center, Carroll County Community College in central Maryland.

Table 4-2
Percentage and Number of MART Participants by Ethnicity

	ETHNICITY					
	BLACK	*WHITE*	*OTHER*	*HISPANIC*	*ASIAN*	*AMERICAN INDIAN*
DISTRICT COLUMBIA	104	0	0	2	3	0
VIRGINIA	22	35	3	1	0	1
MARYLAND	1	44	1	0	0	0
PAVERS	2	24	0	0	0	0
W. VIRGINIA	2	18	0	0	0	0
Grand total	131	121	4	3	3	1
PERCENT	50%	46%	2%	1%	1%	0%

Table 4-3
Percentage and Number of MART Participants by Age

	AGE				
	18-24	*25-34*	*35-44*	*>44*	*Grand total*
DISTRICT COLUMBIA	5	36	34	34	109
VIRGINIA	26	21	12	3	62
MARYLAND	20	14	11	1	46
PAVERS	0	2	11	13	26
W. VIRGINIA	8	8	4	0	20
Grand total	59	81	72	51	263
PERCENT	23%	31%	27%	19%	

Related Training. Almost 80% of the participants reported no prior training in related construction areas; e.g. carpentry, roofing, plumbing and so on. The school based Alliance Programs in Virginia and West Virginia reported the greatest percentage of students with prior participation in related training. Virginia reported thirty percent and West Virginia twenty-five percent. (See Table 4-4.)

Women and Minorities in MART

The Alliances recruitment and outreach activities to women and minorities as well as MART site selection undoubtedly contributed to MART's high percentage of enrollment of females and African Americans in the program. As stated prior, MART enrolled significantly greater numbers of females and African American than the percentage presently represented in the nation's workforce of carpenters.

Eleven percent (11%) of MART's enrollment were females and 50% were African Americans. As cited in the *Employment and Earnings Journal*, nationwide only 1% of our nation's carpenters' are female and 5.4% Black.

Table 4-4
Prior Participation in Related Training Programs

	PRIOR PARTICIPATION IN RELATED TRAINING		
	YES	*NO*	*Grand total*
DISTRICT COLUMBIA	4	105	109
VIRGINIA	18	44	62
MARYLAND	7	39	46
PAVERS	20	6	26
W. VIRGINIA	5	15	20
Grand total	54	209	263
PERCENT	21%	79%	

Education.
Over thirty-five percent (37%) of MART participants were high school graduates and fifteen percent college level education. Only five percent had previously enrolled in vocational-technical schools. Seventeen percent of the students held a GED as the highest level of education achieved. (See Table 4-5)

Employment in Construction Trades

Outcomes. Forty-three percent (43%) of the 263 participants graduated MART training programs. Slightly more than twenty percent (23%) left or dropped out of the program for a variety of reasons. However, more than one-third of MART students continue to be enrolled in training as of October 30, 1993.

Table 4-6
What Outcomes Were Achieve by MART Participants?

	OUTCOMES						
	GRADUATED		*IN TRAINING*		*DROPPED*		*Grand total*
DISTRICT COLUMBIA	34	30%	66	73%	9	15%	109
VIRGINIA	23	20%	10	11%	29	48%	62
MARYLAND	21	19%	14	16%	11	18%	46
PAVERS	26	23%	0	0%	0	0%	26
W. VIRGINIA	9	8%	0	0%	11	18%	20
Grand total	113		90		60		263
PERCENT	43%		34%		23%		

West Virginia and Virginia had about half of their students leave their programs as the result of instructor staff problems. In both locations masonry instructors' could not be recruited soon enough to complete a full-cycle of training or those employed did meet local and MART educational and/or instructional standards.

Employment in construction jobs. Eighty-seven percent of MART students were employed in construction jobs. Of the 130 students available or already working in the construction field (figure excludes students who dropped-out and those still in training) 113 were employed as carpenter framers, masons, apartment maintenance workers and related or kindred workers.

Table 4-7
Employment in Construction
Related and Non-Related Jobs

	EMPLOYMENT				
	NON-RELATED		RELATED		Grand total
DISTRICT COLUMBIA	0	0%	35	31%	35
MARYLAND	8	47%	20	17%	28
PAVERS	0	0%	26	23%	26
VIRGINIA	9	53%	24	21%	33
W. VIRGINIA	1	5%	9	8%	10
Grand total	17		113		130
PEceT	13%		87%		

Table 4-8 illustrates the positive relationship between graduating from MART and related employment. Nearly one hundred percent (99%) of those who graduated the program were employed in the construction trades. However, the inverse held for drop-outs. Ninety-four percent of those participants who dropped out of MART were employed in non-related construction jobs.

Table 4-8
What is the Relationship
Between Employment and MART Outcomes?

	OUTCOME					
	DROPPED		GRADUATED		Grand total	PERCENT
NON-RELATED	17	94%	1	1%	18	11%
RELATED	1	6%	112	99%	113	66%
Grand total	18		113			
PERCENT	11%		66%			

Table 4-5
Level of Education of MART Participants

	LEVEL OF EDUCATION								
	H.S. GRAD.	*<HIGH SCHOOL*	*GED*	*SOME COLLEGE*	*VO-TEC SCHOOL*	*2-YEAR COLLEGE DEGREE*	*4-YEAR COLLEGE DEGREE*	*GRADUATE DEGREE*	*Grand total*
DISTRICT COLUMBIA	37	48	17	5	2	0	0	0	109
MARYLAND	26	6	5	4	2	1	1	1	46
PAVERS	3	0	0	4	5	8	6	0	26
VIRGINIA	24	10	17	7	2	0	2	0	62
W. VIRGINIA	8	1	7	0	3	1	0	0	20
Grand total	98	65	46	20	14	10	9	1	263
PERCENT	37%	25%	17%	8%	5%	4%	3%	0.38%	

What Makes a Difference in MART Outcomes?

The following narrative examines the relationship between gender, ethnicity, age and prior participation in related training and MART outcomes; dropped out, graduated, or still in training. Chi-square statistical analyses were used to investigate the statitical significance of these relationships.

Gender and Outcome. Table 4-9 shows the distribution of males and females and outcomes across all MART sites. The percentage of males and females likely to drop out, graduate or continuing MART sponsored training is strikingly similar. In short, gender does not appear to be a factor in what outcomes MART students achieved based on a non-statistically significant chi-square value of 3.842.

Male and female participants have an equal probability of dropping out, graduating or still being enrolled in MART training. This is of particular significance due to the fact that females make up only 1.0% of the total workforce of carpenters in the nation.

Table 4-9
What is the Relationship Between Gender and MART Outcomes?

	GENDER AND OUTCOME							
	DROPPED		*GRADUATED*		*IN TRAINING*		*Grand total*	*PERCENT*
FEMALE	7	12%	12	11%	9	10%	28	11%
MALE	53	88%	101	89%	81	90%	235	89%
Grand total	60		113		90		263	
PERCENT	23%		43%		34%			

Ethnicity and Outcome. Slightly less than sixty percent (60%) of white Mart students graduated compared to a thirty-one percent (31%) graduation rate for African Americans. However, twenty-eight percent (28%) of white students dropped out of MART in contrast to only eighteen percent (18%) of Blacks. As indicated in Table 4-10 over half (52%) of African Americans are still enrolled in training as of October 30, 1993. The high percentage of representation of African Americans in training undoubtedly effects the proportions of students by ethnic group dropping out or graduating from the program.

As a whole, ethnicity does not appear to be a factor related to MART outcomes. The above table yields non-statistically significant chi-square value of 4.099.

Table 4-10
What is the Relationship
Between Ethnicity and MART Outcomes

	ETHNICITY AND OUTCOME							
	DROPPED		*GRADUATED*		*IN TRAINING*		***Grand total***	***PERCENT***
BLACK	23	38%	40	35%	68	76%	131	50%
WHITE	34	57%	70	61%	17	19%	121	46%
OTHER	3	5%	3	3%	5	6	11	4%
Grand total	60		113		90		263	
PERCENT	23%		43%		34%			

Age and Outcome. More mature MART students (especially those over 35 years of age) are more likely to graduate than students less than 34 years of old. Only fifteen percent (15%) of the students age 35 to 44 dropped out of the program compared to sixty-seven (67%) percent of the students 34 years of age and younger. The chi-square value of 22.65 is significant at the .05 level.

Table 4-11
What is the Relationship
Between Age of Students and MART Outcomes?

	AGE AND OUTCOMES							
	DROPPED		*GRADUATED*		*IN TRAINING*		*Grand total*	*PERCENT*
18-24	22	37%	21	19%	16	18%	59	22%
25-34	24	40%	28	35%	29	36%	81	31%
35-44	11	18%	33	29%	28	31%	72	27%
>44	3	5%	31	27%	17	19%	51	19%
Grand total	60		113		90		263	
PERCENT	23%		43%		34%			

Prior Training and Outcome. Two-thirds of MART students who graduated had prior construction related training. Ninety-one percent (91%) of the students who dropped out of the program did not have the benefit of previous instruction in construction trades. Although 79% of the 263 students enrolled in the program had no prior training of the 60 students who dropped out of the program ninety percent had not been previously enrolled in a vocational education or similar construction related training program. The chi-square value of 15.201 is significant at the .05 level.

Table 4-12 What is the Relationship
Between Prior Participation in Training and MART Outcomes?

	PRIOR PARTICIPATION AND OUTCOMES							
	DROPPED		*GRADUATED*		*IN TRAINING*		*Grand total*	*PERCENT*
YES	11	18%	35	31%	8	9%	54	21%
NO	49	82%	78	69%	82	91%	209	79%
Grand total	60		113		90		263	
PERCENT	23%		43%		34%			

The above analyses suggest that the participant outcomes of regional training as organized and carried out by the Alliance are not significantly moderated by the gender and ethnicity of those enrolled in the program. However, those students with prior training in construction related trades and those above the age of 35 appear to benefit more significantly that other trainees.

Chapter 5

MART CARPENTER FRAMER STANDARDS AND CERTIFICATION

Occupational Performance Certification

MART staff developed an occupational performance test battery designed to certify mastery of skills of skilled carpenter framers. The test battery consisted of five test and was designed to meet the following requirements:

- The content and skill that each test is intended to measure is important to successful job performance as defined by subject matter experts.
- The battery of five performance tests is an adequate sample of the tasks required on the job.
- *Prepared and qualified* applicants have sufficient knowledge and skills to correctly perform each task.
- The mastery level of performance on each test is established by competent job authorities

The purpose of the carpentry skills performance tests is to classify individuals in two categories: qualified and non-qualified framers. This type of measurement (i.e. criterion-referenced measurement) treats the score as a sign that the exminee can or cannot be expected to satisfy some performance requirement in a situation like the test. This type of measurement is not designed to compare an examinee to other people who took the test. This measurement classified people into two groups, one qualified and the other non-qualified.

The most appropriate strategy for establishing the validity of these types of tests is referred to as "*comparison of known groups*". If the tests are administered to a group of qualified framers and to a second group of non-qualified framers the results of the performance test should distribute the framers in the corrects groups at least 90% of the time. This is also referred to as "*concurrent validation*" since the predictor (performance test) and the criterion (performance ratings by subject matter experts) data are gathered at the same time. For the purposes of the project *qualified* framers are defined as (a) carpenter framers who have at least one year of on the job experience and are judged by their employers as competent and prepared, or (b) MART graduates or soon to be graduates of the carpenter framing training. *Non-qualified* carpenter framers are defined as MART trainees who have some experience in framing but have not

achieved the level of skill required for qualified framers as judged by their instructor.

MART Skills Standards Model

The development of standards begins with the identification of the content or domain of carpenter framers. This step is commonly referred to as content validation. Content validation leads to the knowledges, skills and abilities required for qualified carpenter framers to successfully perform on the job. The following is the MART model for skills standards development:

Content Validation

- Review of the literature including carpentry curricula, vocational program standards and performance standards and testing.
- Organize duties and task of carpenter framer in logical clusters or domains.
- Survey job incumbents in the Mid-Atlantic region and determine the importance and frequency of framer tasks.
- Rank order tasks by importance and frequency and select critical task or skill standards development.

Criteria for Skills Standards

- Develop resources, environmental and materials conditions, time, process and quality criteria for each task.
- Survey job incumbents in Mid-Atlantic region and revise task criteria as appropriate.
- Assemble panel of framing contractors and determine rater agreement between subject matter experts of criteria.
- Revise standards as required.

Estimate Reliability and Criterion-Related Validity of Skill Standards Performance Tests

- Develop performance tests for critical tasks.
- Estimate inter-rater reliability of individual performance tests.
- Determine ability of tests to classify framers into two know groups of qualified and non-qualified carpenter framers.

Duty/Task Ratings

The survey questionnaire used to collect data about the importance and frequency of carpenter framer tasks is found in Appendix B. The following is a summary of the results organized by major clusters/domains of duties and tasks.

Table 5-1
Frequency and Importance
of Major Duties and Tasks for Qualified Carpenter Framer
N = 33

	DUTY AND TASK RATINGS			
	FREQUENCY		*IMPORTANCE*	
	MEAN	*STDEV*	*MEAN*	*STDEV*
GENERAL CONSTRUCTION	3.15	1.07	3.08	1.05
BUILDING MATERIALS	3.75	0.54	3.29	0.08
SPECIFICATIONS	2.78	1.24	2.7	1.2
TOOLS AND EQUIPMENT	2.8	1.1	2.81	1.1
FLOORS	3.18	1.13	3.45	0.99
WALLS AND CEILINGS	3.15	0.98	3.45	1.1
ROOFS	2.72	1.18	3.11	0.91
TRUSSES	2.61	1.18	3.09	1.11
STAIRS	2.16	1.29	2.98	1.34
DOORS AND WINDOWS	2.78	1.11	3.3	1.03
PORCHES	2.73	1.26	3.47	0.86

The ratings scales used in the above survey are as follows:

Frequency	**Importance**
1. Quarterly	1. Slight
2. Monthly	2. Moderate
3. Weekly	3. High
4. Daily	4. Very High

The above survey results were based on a sample of thirty-three carpenter framers (subject matter experts) in the Mid-Atlantic region; about a 30 % response rate. Over ninety percent (94.%) of the respondents had more than ten years of related job experience. Almost fifty percent (45%) held a high school degree and almost twenty-five percent (23%) was a trades apprentice.

Table 5-2
Education
Level of Survey Respondents

	EDUCATION	
	NUMBER	*PERCENT*
<HS	2	6%
GED	2	6%
HS DIPLOMA	14	45%
TECHNICAL DEGREE	1	3%
TRADES APPRENTICE	7	23%
BACHELORS DEGREE	3	10%
MASTERS DEGREE	2	6%
Grand Total	31	

Note: Two respondents did not complete this part of survey.

Table 5-3
Work Experience
of Survey Respondents

	EXPERIENCE	
YEARS	NUMBER	PERCENT
<ONE	0	0%
TWO - THREE	0	0%
FOUR - FIVE	1	3%
SIX - SEVEN	0	0%
EIGHT - NINE	1	3%
>TEN	31	94%
Grand total	33	

The survey data was organized into the following clusters of duties and rank ordered by frequency and importance ratings:

1. Frame Floors and Sills
2. Frame Walls and Ceilings
3. Frame Roofs
4. Lay out, Build and Install trusses
5. Construct and Install Stairs
6. Install Doors and Windows
7. Construct Porches and Decks

Duties/tasks covering general construction safety, building materials, interpreting blueprints and building specifications and tools and equipment were embedded with the above seven duty clusters. A complete list of duties and tasks rank ordered by frequency and importance are found in Appendix B.

Standards Development

HBI developed skill standards for all tasks included in the seven major duty clusters for each of the following categories:

1. *Resources* (equipment, materials, etc.) needed to complete the task.
2. *Environmental conditions* needed; dry, between 50 and 90 degrees of temperature, etc.
3. Length of *time* required to complete the task.
4. *Quality* standards; finished joist plus or minus 1/4".
5. Performance *sequence*; the proper order for completing the task.

MART staff used subject matter experts employed at the HBI, members of local home builders associations as well as time and materials standards documents used by home builders and architects in determining the above standards.

A panel of six carpenter framers and framing subcontractors contractors (subject matter experts) was assembled by MART staff. This panel met at HBI and under the direction of HBI curriculum specialists reviewed each of the tasks (N = 89) and related standards of the basis of the following questions using a seven point rating scale:

1. Is this the minimum level of performance you would expect from a "skilled" framer?
2. Are the Resources appropriate?
3. Are the Conditions appropriate?
4. Are the Time Limitations appropriate?
5. Are the Quality Requirements appropriate?
6. Is the Performance Sequence appropriate?

Rater agreement across tasks for each of the above questions ranged from 100.00% to 86%.

Standards Based Performance Tests

MART selected the following tasks as the basis for performance test development using the combined criteria of importance and frequency. These tasks received average ratings of 3.5 or greater on frequency and importance of performance as determined by the initial survey of 33 carpenter framers and framing contractors.

1. Floor joist lay out
2. Wall lay out
3. Wall assembly
4. Common rafter lay out, cutting and fitting
5. Window installation

A performance test including the above parts or sub-tests was developed by MART staff. The following sections were included for each part:

- Task Statement
- Resources Required
- Conditions
- Time Limitation
- Process Evaluation/Performance Sequence
- Product Evaluation/Quality Requirements

A pass/fail scoring system was used. A passing score was achieved when an examinee (a) completed the task within the time limitations; (b) performance the task in the proper sequence; and (c) met all the quality requirements. The performance test was designed so that an examinee, in most instances, could be

re-tested on only that part of the test which he/she failed. Appendix C includes the performance test developed for use in this project.

Pre-test Administration

The qualified framer performance test was administered to a sample of 39 subjects. Nine of the subjects were classified as non-qualified carpenter framers on the basis of length of time in training or on the job. Thirty subjects were classified as qualified-framers as judged by their employers (carpenter framer subcontractors),or by their MART instructor as being fully prepared and qualified. The average length of job experience of those employed full-time as carpenter framers was 6.8 years.

The 39 subjects was administered various parts of the performance test and scored by at least two independent raters. Analysis of score results indicate that there was 100% inter-rater agreement between raters.

TABLE 5-4
PRE-TEST RESULTS

	FLOOR JOIST LAYOUT	
	PASS	***FAIL***
QUALIFIED	1	0
NON-QUALIFIED	1	2

	WALL LAYOUT	
	PASS	***FAIL***
QUALIFIED	6	0
NON-QUALIFIED	0	0

	COMMON RAFTER	
	PASS	***FAIL***
QUALIFIED	6	0
NON-QUALIFIED	0	5

	WINDOW INSTALLATION	
	PASS	***FAIL***
QUALIFIED	8	0
NON-QUALIFIED	0	0

	WALL ASSEMBLY	
	PASS	***FAIL***
QUALIFIED	10	0
NON-QUALIFIED	1	0

The number of subjects participating in the pre-test are too few to draw statistically significant conclusions. However, the high degree of inter-rater reliability, the multi-step process used in establishing content validity and the use numerous groups of subject matter experts indicate that the MART carpenter framer performance test meets federal and professional standards (e.g. National Council on Measurement in Education and American Psychological Association) for occupational certification tests.

PART IV: CHALLENGES FACING A REGIONAL TRAINING STRATEGY

Chapter 6

RECOMMENDATIONS

1. The Center's outreach, recruitment, work based training and job placement among other activities were effective with a young adult and adult out-of-school population. However, replication with an adolescent in-school population is recommended to more fully understand the effectiveness and efficacy of the Center concept as a major new strategy for job training.

2. All job training programs, especially those that serve representatives of special populations should offer a broad array of in-house as well as referral services. Such services should include child care, transportation, access to up-to-date training and job availability information, basic skills remediation beyond GED preparation, job counseling and instruction in life skills among others. These services are needed in addition to a strong "pro training" approach.

3. The Center concept should be replicated in other than residential construction industries to assess its potential for leveraging financial, material and other resources in pursuit of industry supported training.

4. The standards developed under this grant are a solid basis for a national carpenter framer certification system. Consideration should be directed at further expansion of the standards and related performance tests for student, employee and teacher certification.

APPENDIX A

CARPENTRY: QUALIFIED FRAMER DUTY/TASK LIST

		FREQUENCY					IMPORTANCE				
		N/A	Quarterly	Monthly	Weekly	Daily	N/A	Slight	Moderate	High	Very High
PRACTICE GENERAL CONSTRUCTION SAFETY											
1.	Identify and correct safety hazards.										
2.	Apply prescribed OSHA safety standards.										
3.	Identify and wear appropriate personal protective equipment.										
4.	Use proper procedures for lifting and carrying heavy objects.										
5.	Apply good housekeeping practices.										
6.	Identify and use appropriate fire safety equipment.										
7.	Apply basic first aid techniques.										
IDENTIFY CHARACTERISTICS AND USES OF BUILDING MATERIALS											
1.	Identify basic house framing components.										
2.	Identify framing lumber.										
3.	Identify sheathing materials.										
4.	Identify grades of building materials.										
5.	Interpret building material specifications.										
6.	Identify defects in building materials.										
7.	Identify fasteners and adhesives.										
8.	Identify nailing patterns and anchoring requirements.										
9.	Stack and/or store building materials.										
INTERPRET BLUEPRINTS AND BUILDING SPECIFICATIONS											
1.	Interpret a variety of drawing formats (i.e., plan, detail, section, elevation).										
2.	Interpret architectural building symbols and abbreviations.										
3.	Interpret building specifications and drawing notes.										
4.	Interpret door, window and finish schedules.										
5.	Locate mechanical fixtures on drawings that require framing alterations (i.e., plumbing, heating ducts).										
6.	Read/use an architect's scale.										

Place an "X" in the appropriate boxes

CARPENTRY: QUALIFIED FRAMER DUTY/TASK LIST

	FREQUENCY					IMPORTANCE				
	N/A	Quarterly	Monthly	Weekly	Daily	N/A	Slight	Moderate	High	Very High
7. Draw framing plans and elevations.										
8. Compute board feet measurements.										
9. Compute square feet measurements.										
10. Compute lineal feet measurements.										
11. Estimate required material quantities from drawings.										
12. Write building material requisitions.										
MAINTAIN AND SAFELY OPERATE HAND TOOLS, POWER TOOLS AND EQUIPMENT										
1. Identify hand and power tools used by car penters.										
2. Identify specific uses of hand and power tools.										
3. Apply hand and power tool safety rules.										
4. Maintain hand and power tools.										
5. Read/use measurement and lay out tools.										
a. tape measure										
b. folding wood rule										
c. framing (rafter) square										
d. combination square										
e. carpenter's level										
f. line level										
g. leveling rods										
h. builder's transit level										
i. plumb bob										
j. sliding T-bevel										
k. chalk box										
6. Use hammers.										
a. claw										
b. framing										
c. sledge										
7. Use nail sets.										
8. Use wood chisels.										
9. Use cold chisels.										
10. Use pry bars.										
11. Use cats paws (nail claws).										

Place an "X" in the appropriate boxes

CARPENTRY: QUALIFIED FRAMER DUTY/TASK LIST

	FREQUENCY					IMPORTANCE				
	N/A	Quarterly	Monthly	Weekly	Daily	N/A	Slight	Moderate	High	Very High
12. Use screwdrivers (slotted and phillips).										
13. Use hand saws.										
a. miter box										
b. hack saw										
c. crosscut saw										
d. rip saw										
14. Use block planes.										
15. Use files and wood rasps.										
16. Use utility knives.										
17. Use aviation snips.										
18. Use clamping and holding devices.										
a. C-clamp										
b. bar clamp										
c. vise										
19. Use vise grips.										
20. Use pliers.										
21. Use wrenches.										
a. adjustable wrench										
b. socket wrench										
c. box or open-end wrench										
22. Use hand and push brooms.										
23. Use glue or caulking guns.										
24. Operate power saws.										
a. power miter box										
b. sawbuck frame and trim saw										
c. circular saw										
d. saber saw										
e. reciprocating saw										
25. Operate portable electric planes.										
26. Operate portable electric drills.										
27. Operate electric screwdrivers.										
28. Operate portable routers.										
29. Operate portable belt sanders.										
30. Operate pneumatic tools and equipment.										
a. air compressor										
b. impact wrench										
c. stapler										
d. nailer										
31. Operate portable generators.										
32. Operate powder-actuated tools.										

Place an "X" in the appropriate boxes

CARPENTRY: QUALIFIED FRAMER DUTY/TASK LIST

	FREQUENCY					IMPORTANCE				
	N/A	Quarterly	Monthly	Weekly	Daily	N/A	Slight	Moderate	High	Very High
33. Perform cutting operations.										
a. crosscut										
b. ripping										
c. bevel										
d. miter										
e. compound miter										
34. Apply prescribed ladder safety rules.										
35. Maintain ladders.										
36. Select proper ladders for job requirements.										
37. Set-up common ladder configurations.										
a. single ladder										
b. extension ladder										
c. step ladder										
38. Apply prescribed scaffold safety rules.										
39. Maintain scaffolds.										
40. Select proper scaffolds for job requirements.										
41. Set-up common scaffold configurations.										
a. single-pole scaffold										
b. double-pole scaffold										
c. lightweight stairway scaffold										
d. simple scaffold using scaffold horses										
e. sectional steel scaffold										
FRAME FLOORS AND SILLS										
1. Identify materials and hardware for floor assemblies.										
2. Determine proper beam and girder sizes for ordinary load conditions.										
3. Determine proper floor joist size for ordinary load conditions.										
4. Check foundations, adjust and square floor frames.										
5. Compute lengths of floor framing components from drawings.										
6. Cut floor framing components.										
7. Install steel beams.										
8. Install solid wood beams.										
9. Install built-up wood girders.										

Place an "X" in the appropriate boxes

CARPENTRY: QUALIFIED FRAMER DUTY/TASK LIST

	FREQUENCY					IMPORTANCE				
	N/A	Quarterly	Monthly	Weekly	Daily	N/A	Slight	Moderate	High	Very High
10. Install wood posts.										
11. Install lally columns.										
12. Install sill plates.										
13. Lay out floor assemblies.										
14. Install floor joists.										
15. Frame floor openings.										
16. Install joists for cantilever floors.										
17. Install bridging and blocking.										
18. Install subfloors.										
FRAME WALLS AND CEILINGS										
1. Identify materials and hardware for wall sections.										
2. Locate and strike wall locations on subfloors and concrete slabs (snapping out).										
3. Calculate rough opening dimensions for windows and doors.										
4. Compute lengths of wall framing components from drawings.										
5. Cut wall framing components.										
6. Lay out wall assemblies on sole and top plates.										
7. Construct corner posts and intersecting ties.										
8. Construct headers.										
9. Frame door openings.										
10. Frame window openings.										
11. Install girder posts.										
12. Assemble wall sections.										
13. Install backing for fixtures and cabinets.										
14. Install firestops.										
15. Construct plywood box beams.										
16. Install diagonal wall bracing.										
17. Raise and anchor wall sections.										
18. Align, plumb and brace wall sections.										
19. Frame plumbing partitions for soil and vent pipes.										
20. Install wall sheathing.										
21. Install battens.										
22. Identify materials & hardware for ceiling assemblies.										

Place an "X" in the appropriate boxes

CARPENTRY: QUALIFIED FRAMER DUTY/TASK LIST

	FREQUENCY					IMPORTANCE				
	N/A	Quarterly	Monthly	Weekly	Daily	N/A	Slight	Moderate	High	Very High
23. Determine proper ceiling joist size for ordinary load conditions.										
24. Compute lengths of ceiling framing components from drawings.										
25. Cut ceiling framing components.										
26. Lay out ceiling assemblies.										
27. Install ceiling joists.										
28. Frame ceiling openings.										
29. Install strongbacks (stiffbacks).										
30. Construct soffit for wall cabinets.										
31. Frame tray and cathedral ceilings.										
32. Construct post and beam frame assemblies.										
33. Construct walls and partitions with metal framing components										
34. Install house wrap										
FRAME ROOFS										
1. Identify styles of roof construction.										
2. Compute rise and run of roofs.										
3. Identify materials and hardware for gable and hip roof assemblies.										
4. Determine proper rafter size for ordinary load conditions.										
5. Compute dimensions of roof framing components from drawings.										
6. Lay out roof framing components for gable and hip roof assemblies.										
7. Cut roof framing components.										
8. Install ridgeboards.										
9. Frame roof openings.										
10. Install common rafters.										
11. Install cornice and eaves framing components.										
12. Frame intersecting gable roofs.										
13. Install gable studs.										
14. Frame snub gables.										
15. Frame chimney saddles (crickets).										
16. Frame gable dormers.										
17. Frame shed dormers.										
18. Install gambrel roof rafters.										
19. Install valley jack rafters.										
20. Install valley rafters.										

Place an "X" in the appropriate boxes

CARPENTRY: QUALIFIED FRAMER DUTY/TASK LIST

	FREQUENCY					IMPORTANCE				
	N/A	Quarterly	Monthly	Weekly	Daily	N/A	Slight	Moderate	High	Very High
21. Install hip jack rafters.										
22. Install hip rafters.										
23. Install cripple jack rafters.										
24. Install tail rafters.										
25. Install overhang purlins (gable ends).										
26. Install rafter support purlins.										
27. Install collar ties.										
28. Install roof sheathing.										
29. Install roofing felt paper.										
LAY OUT, CONSTRUCT AND INSTALL TRUSSES										
1. Identify materials and hardware for gable and hip truss roof assemblies.										
2. Identify materials and hardware for truss floor assemblies.										
3. Compute dimensions of trusses from drawings.										
4. Interpret truss installation drawings and specifications.										
5. Lay out for truss installation.										
6. Set trusses by hand.										
7. Set trusses with light cranes.										
8. Brace truss assemblies.										
9. Frame openings in truss assemblies.										
10. Construct gable roof trusses.										
11. Install overlay valley rafters.										
12. Install overlay valley jacks.										
CONSTRUCT AND INSTALL STAIRS										
1. Identify types of stair construction.										
2. Identify materials and hardware for stair assemblies.										
3. Compute dimensions of stair components from drawings.										
4. Compute rise and run of stairs.										

Place an "X" in the appropriate boxes

CARPENTRY: QUALIFIED FRAMER DUTY/TASK LIST

	FREQUENCY					IMPORTANCE				
	N/A	Quarterly	Monthly	Weekly	Daily	N/A	Slight	Moderate	High	Very High
5. Compute stairwell opening sizes from drawings.										
6. Lay out stair components.										
7. Cut stair components.										
8. Construct open riser stairs.										
9. Construct box stairs.										
10. Construct built-up stringers.										
11. Construct cleated stringers.										
12. Install prefabricated stair units.										
13. Install disappearing stair units.										
14. Install wood railing components.										
15. Install metal railing components.										
INSTALL DOORS AND WINDOWS										
1. Identify types of window and door design.										
2. Identify materials and hardware for exterior door and window installation.										
3. Install exterior window units.										
4. Install prehung exterior door units.										
5. Install exterior doors, jambs and trim.										
6. Install door locks, hardware and weather stripping.										
7. Install thresholds.										
8. Install door frames, inside jambs and trim for overhead doors.										
9. Install garage doors.										
10. Install sliding glass and french patio door units.										
11. Install transoms.										
CONSTRUCT PORCHES AND DECKS										
1. Identify materials and hardware for porch and deck assemblies.										
2. Determine proper post, beam and joist sizes for ordinary load conditions.										

Place an "X" in the appropriate boxes

CARPENTRY: QUALIFIED FRAMER DUTY/TASK LIST

	FREQUENCY					IMPORTANCE				
	N/A	Quarterly	Monthly	Weekly	Daily	N/A	Slight	Moderate	High	Very High
3. Compute lengths of porch and deck components from drawings.										
4. Cut porch and deck components.										
5. Lay out porch and deck assemblies.										
6. Install posts (permanent).										
7. Install posts (temporary).										
8. Install beams.										
9. Install floor joists.										
10. Install decking (planking).										
11. Construct stairs.										
12. Install stairs.										
13. Install railing components.										
14. Install skirting.										

Place an "X" in the appropriate boxes

Thanks for your help!

Please return this survey in the enclosed, self-adressed stamped envelope.

APPENDIX B

INDUSTRY-EDUCATION ALLIANCE

CARPENTRY: QUALIFIED FRAMER COMPETENCY PROFILE

Trainee Name: _____
Last First Middle

Home Address: _____
Number, Street and/or P.O. Box

_____
City, State, Zip Code

Home Phone: (____) _____
Area Code

Emergency Contact: _____
Name Phone

Social Security #: _____ – _____ – _____

Visual Inspection Driver's License: ___ Yes ___ No ID # _____

Alliance Site: _____

Instructor Phone: (____) _____
Area Code

Date Entered Training: _____
Month / Day / Year

Date Completed (or Terminated): _____
Month / Day / Year

STATUS:
Non-completer ☐
Completer ☐
Advanced Completer ☐

Total Cumulative Hours _____

Sign below upon completion/termination:

_____ Trainee Signature

_____ Instructor Signature

DIRECTIONS:
When the trainee successfully performs each of the tasks listed in the left column of the CP, the instructor should:

(1) Write the date that the Trainee mastered the task listed in the column labeled "Date Completed".
NOTE: You may use any one of several methods to determine whether a trainee has "mastered" a task. Optional rating scales are listed on the CP for your convenience. If you elect to use the rating scale, use a pencil to circle the level of skill achieved by the Trainee for each task. As skill improves, circle the higher level achieved. When the trainee achieves a performance level 3 or higher, the task is considered to be mastered.
(2) Sign the instructor's initials in the column labeled "Instr's Initials."
(3) Have the Trainee sign his or her initials in the column labeled "Train's Initials."

OPTIONAL RATING SCALE
4—Skilled; can work independently with no supervision.
3—Moderately skilled; can perform job with limited supervision.
2—Limited skill; requires instruction and close supervision.
1—No instruction in this area.

Instructional Resources:

Carpentry (2nd Ed.)—Textbook, Workbook, & Instructor's Guide
Practical Problems in Mathematics for Carpenters—Textbook
Periodicals:
Fine Homebuilding
Journal of Light Construction
Builder Magazine
Others
Construction Video Library

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Qualified Framer		Carpentry (2nd Ed.)	Practical Problems In Mathematics for Carpenters	Construction Resource Library	Date Completed	Instr Initials	Train Initials
A. Introduction To Trade Principles							
1. Describe the carpentry program, requirements and training objectives.	4 3 2 1	Unit: 2		Reading, Verbal Communication, Problem Solving, Written Communication			
2. Describe carpentry as a trade.	4 3 2 1						
3. Describe the role of a carpenter on the job.	4 3 2 1						
4. Identify and distinguish employment opportunities in the carpentry industry.	4 3 2 1						
5. Work cooperatively with other crafts-persons and management.	4 3 2 1						
6. Practice proper work ethics on assigned projects.	4 3 2 1						
B. Practice General Construction Safety							
1. Identify and correct safety hazards.	4 3 2 1	Units: 20, 22	Whole numbers, Common Fractions, Percent and Percentage, Measurement Units: 1–9, 15, 18–27	Reading, Problem Solving, Verbal Communication			
2. Demonstrate alertness to potentially dangerous situations.	4 3 2 1						
3. Follow appropriate procedure for handling common chemicals.	4 3 2 1						
4. Apply prescribed OSHA safety standards.	4 3 2 1						
5. Identify and wear appropriate personal protective equipment.	4 3 2 1						
6. Use proper procedures for lifting and carrying heavy objects.	4 3 2 1						
7. Apply appropriate housekeeping practices.	4 3 2 1						
8. Identify and use appropriate fire safety equipment.	4 3 2 1						
C. Practice Basic First Aid							
1. Report all injuries immediately to the instructor.	4 3 2 1						
2. Identify locations of first aid equipment and materials.	4 3 2 1						
3. Refrain from treating injuries or allowing others to do so unless the individual is qualified.	4 3 2 1						
4. Demonstrate appropriate procedures for stopping severe bleeding.	4 3 2 1						
5. Demonstrate safety procedures used with seriously injured individuals.	4 3 2 1						
D. Identify Characteristics and Uses of Building Materials							
1. Identify basic house framing components.	4 3 2 1	Units: 3–5, 7, & 8	Whole numbers, Common Fractions, Measurement Units: 1–9, 18–27	Reading, Verbal Communication, Written Communication, Vocabulary			
2. Identify framing lumber.	4 3 2 1						
3. Identify sheathing materials.	4 3 2 1						
4. Identify grades of building materials.	4 3 2 1						
5. Interpret building material specifications.	4 3 2 1						
6. Identify defects in building materials.	4 3 2 1						
7. Identify fasteners and adhesives.	4 3 2 1						
8. Identify nailing patterns and anchoring requirements.	4 3 2 1						
9. Stack and/or store building materials.	4 3 2 1						

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Qualified Framer		Carpentry (2nd Ed.)	Practical Problems in Mathematics for Carpenters	Construction Resource Library	Date Completed	Instr. Initials	Trainee Initials
E. Interpret Blueprints and Building Specifications							
1. Interpret a variety of drawing formats (i.e., plan, detail, section, elevation).	4 3 2 1	Units: 6, 23–31	Whole numbers, Common Fractions, Measurement Units: 1–9, 18–27	Problem Solving Verbal Communication, Vocabulary, Reading			
2. Interpret architectural building symbols and abbreviations.	4 3 2 1						
3. Interpret building specifications and drawing notes.	4 3 2 1						
4. Interpret door, window and finish schedules.	4 3 2 1						
5. Locate mechanical fixtures on drawings that require framing alterations (i.e., plumbing, heating ducts).	4 3 2 1						
6. Read/use an architect's scale.	4 3 2 1						
7. Compute square feet measurements.	4 3 2 1						
8. Compute lineal feet measurements.	4 3 2 1						
9. Estimate required material quantities from drawings.	4 3 2 1						
10. Write building material requisitions.	4 3 2 1						
F. Maintain and Safely Operate Hand Tools							
1. Identify hand tools used by carpenters.	4 3 2 1	Units: 9–11, 33		Verbal Communication, Reading, Vocabulary			
2. Identify specific uses of hand tools.	4 3 2 1						
3. Practice hand tool safety.	4 3 2 1						
4. Maintain hand tools.	4 3 2 1						
5. Read/use measurement and lay out tools:							
a. tape measure	4 3 2 1						
b. framing (rafter) square	4 3 2 1						
c. combination square	4 3 2 1						
d. carpenter's level	4 3 2 1						
e. builder's transit level	4 3 2 1						
f. plumb bob	4 3 2 1						
g. chalk box	4 3 2 1						
6. Use hammers:							
a. claw	4 3 2 1						
b. framing	4 3 2 1						
c. sledge	4 3 2 1						
7. Use nail sets.	4 3 2 1						
8. Use wood chisels.	4 3 2 1						
9. Use pry bars.	4 3 2 1						
10. Use cats paws (nail claws).	4 3 2 1						
11. Use screwdrivers (slotted and Phillips).	4 3 2 1						
12. Use hand saws							
a. miter box	4 3 2 1						
b. hack saw	4 3 2 1						
c. crosscut saw	4 3 2 1						
d. rip saw	4 3 2 1						
13. Use utility knives.	4 3 2 1						
14. Use aviation snips.	4 3 2 1						

Qualified Framer		Carpentry (2nd Ed.)	Practical Problems in Mathematics for Carpenters	Construction Resource Library	Date Completed	Instr Initials	Train Initials
15. Use vise grips.	4321						
16. Use pliers.	4321						
17. Use wrenches:							
a. adjustable wrench	4321						
b. socket wrench	4321						
c. box or open-end wrench	4321						
18. Use hand and push brooms.	4321						
19. Use glue or caulking guns.	4321						
G. Maintain and Safely Operate Power Tools							
1. Identify power tools used by carpenters.	4321	Units: 14–16, 18		Verbal Communication, Reading, Vocabulary			
2. Identify specific uses of power tools.	4321						
3. Practice power tool safety.	4321						
4. Maintain power tools.	4321						
5. Operate power saws:							
a. power miter box	4321						
b. sawbuck frame and trim saw	4321						
c. circular saw	4321						
d. saber saw	4321						
e. reciprocating saw	4321						
6. Operate portable electric planes.	4321						
7. Operate portable electric drills.	4321						
8. Operate electric screwdrivers.	4321						
9. Operate pneumatic tools and equipment:							
a. air compressor	4321						
b. stapler	4321						
c. nailer	4321						
10. Operate portable generators.	4321						
11. Operate power-actuated tools.	4321						
12. Perform cutting operations:							
a. crosscut	4321						
b. rip	4321						
c. bevel	4321						
d. miter	4321						
e. compound miter	4321						
H. Maintain and Safely Operate Site Equipment							
1. Select proper ladders for job requirements.	4321	Unit: 20		Verbal Communication, Reading, Vocabulary			
2. Practice ladder safety.	4321						
3. Maintain ladders.	4321						

Continued

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Qualified Framer		Carpentry (2nd Ed.)	Practical Problems in Mathematics for Carpenters	Construction Resource Library	Date Completed	Instr Initials	Train Initials
4. Set-up common ladder configurations:							
a. single ladder	4 3 2 1						
b. extension ladder	4 3 2 1						
c. step ladder	4 3 2 1						
5. Select proper scaffolds for job requirements.	4 3 2 1						
6. Practice scaffold safety.	4 3 2 1						
7. Maintain scaffolds.	4 3 2 1						
8. Set-up common scaffold configurations:							
a. single-pole scaffold	4 3 2 1						
b. simple scaffold using scaffold horses	4 3 2 1						
c. sectional steel scaffold	4 3 2 1						
I. Floor Framing		Unit: 42	Whole numbers, Common Fractions, Measurement, Estimating **Units:** 1–9, 18–27, 36	Written Communication, Problem Solving, Vocabulary, Verbal Communication, Reading			
1. Check condition of foundation.	4 3 2 1						
2. Install sill plate.	4 3 2 1						
3. Install wood post.	4 3 2 1						
4. Install solid and composite wood beam.	4 3 2 1						
5. Install built-up wood girder.	4 3 2 1						
6. Install steel beam.	4 3 2 1						
7. Install lally column.	4 3 2 1						
8. Lay out floor framing detail on sill plate.	4 3 2 1						
9. Cut floor joists.	4 3 2 1						
10. Frame floor opening.	4 3 2 1						
11. Install floor joists.	4 3 2 1						
12. Install cantilevered floor joists.	4 3 2 1						
13. Install bridging and blocking.	4 3 2 1						
14. Install subfloor sheathing.	4 3 2 1						
J. Wall Framing		Unit: 43	Whole numbers, Common Fractions, Measurement, Estimating **Units:** 1–9, 18–27, 36	Written Communication, Problem Solving, Vocabulary, Verbal Communication, Reading			
1. Lay out walls on floor deck.	4 3 2 1						
2. Cut wall plates.	4 3 2 1						
3. Lay out wall framing detail on wall plates.	4 3 2 1						
4. Cut studs, headers, jacks, rough sills and cripples.	4 3 2 1						
5. Assemble corner and tee posts.	4 3 2 1						
6. Assemble header.	4 3 2 1						
7. Frame door opening.	4 3 2 1						
8. Frame window opening.	4 3 2 1						
9. Assemble wall section.	4 3 2 1						
10. Install double top plate (cap plate).	4 3 2 1						
11. Install wall blocking (backing).	4 3 2 1						
12. Install fire stops.	4 3 2 1						
13. Install corner brace.	4 3 2 1						

Continued

Qualified Framer		Carpentry (2nd Ed.)	Practical Problems in Mathematics for Carpenters	Construction Resource Library	Date Completed	Instr Initials	Train Initials
14. Install exterior wall sheathing.	4 3 2 1						
15. Raise and anchor wall section.	4 3 2 1	----------	Continued	----------			
16. Plumb, align and brace wall section.	4 3 2 1						
K. Ceiling Framing							
1. Lay out ceiling framing detail on top wall plate.	4 3 2 1	Unit: 44	Whole numbers, Common Fractions, Measurement, Estimating Units: 1–9, 18–27, 36	Written Communication, Problem Solving, Vocabulary, Verbal Communication, Reading			
2. Cut ceiling joists.	4 3 2 1						
3. Install ceiling joists.	4 3 2 1						
4. Frame ceiling opening.	4 3 2 1						
5. Install ribband.	4 3 2 1						
6. Install strongback (stiffener or catwalk).	4 3 2 1						
7. Install ceiling backing (deadwood or nailers).	4 3 2 1						
8. Fasten ceiling joists to partition walls.	4 3 2 1						
9. Frame interior soffit.	4 3 2 1						
L. Roof Framing							
1. Lay out roof framing detail on cap plate.	4 3 2 1	Units: 46–49	Whole numbers, Common Fractions, Measurement, Estimating Units: 1–9, 18–27, 36	Written Communication, Problem Solving, Vocabulary, Verbal Communication, Reading			
2. Lay out common, header and cripple rafters.	4 3 2 1						
3. Cut rafters.	4 3 2 1						
4. Install ridgeboard.	4 3 2 1						
5. Frame roof opening.	4 3 2 1						
6. Install rafters.	4 3 2 1						
7. Install sub-fascia.	4 3 2 1						
8. Frame gable end.	4 3 2 1						
9. Frame gable end overhang.	4 3 2 1						
10. Frame blind valley (overlay valley).	4 3 2 1						
11. Frame gable dormer.	4 3 2 1						
12. Frame shed dormer.	4 3 2 1						
13. Install collar beams (rafter ties).	4 3 2 1						
14. Install rafter support purlins.	4 3 2 1						
15. Install roof sheathing.	4 3 2 1						
16. Frame chimney saddle (cricket).	4 3 2 1						
17. Install asphalt building paper (roofing felt).	4 3 2 1						
M. Truss Installation							
1. Lay out for truss installation.	4 3 2 1	Unit: 50	Whole numbers, Common Fractions, Measurement, Estimating Units: 1–9, 18–27, 41, 44	Written Communication, Problem Solving, Vocabulary, Verbal Communication, Reading			
2. Set trusses by hand.	4 3 2 1						
3. Set trusses with light crane.	4 3 2 1						
4. Brace trussed roof assembly.	4 3 2 1						
5. Frame opening in trussed roof assembly.	4 3 2 1						

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Qualified Framer		Carpentry (2nd Ed.)	Practical Problems in Mathematics for Carpenters	Construction Resource Library	Date Completed	Instr Initials	Train Initials
N. Stair Construction and Installation							
1. Lay out straight run stair stringer.	4 3 2 1	Units: 63 & 64	Whole numbers, Common Fractions, Measurement Units: 1–9, 18–27	Written Communication, Problem Solving, Vocabulary, Verbal Communication, Reading			
2. Cut basement stair components.	4 3 2 1						
3. Construct basement stair unit.	4 3 2 1						
4. Install prefabricated stair unit.	4 3 2 1						
O. Door and Window Installation							
1. Install prehung window.	4 3 2 1	Unit: 56	Whole numbers, Common Fractions, Measurement Units: 1–9, 18–27	Written Communication, Problem Solving, Vocabulary, Verbal Communication, Reading			
2. Install prehung exterior door.	4 3 2 1						
3. Install sidelight.	4 3 2 1						
4. Install transom.	4 3 2 1						
5. Assemble and install sliding glass or French patio door.	4 3 2 1						
6. Install inside jamb for garage door.	4 3 2 1						
P. Porch and Deck Framing							
1. Install ledger board.	4 3 2 1	Unit: 57	Whole numbers, Common Fractions, Measurement Units: 1–9, 18–27	Written Communication, Problem Solving, Vocabulary, Verbal Communication, Reading			
2. Install wood support posts.	4 3 2 1						
3. Install solid wood beam.	4 3 2 1						
4. Install built-up wood girder.	4 3 2 1						
5. Install floor joists.	4 3 2 1						
6. Install decking (planking).	4 3 2 1						
7. Install railing.	4 3 2 1						

APPENDIX C

PRELIMINARY CHECKLIST
AND SCORE SHEET

RESIDENTIAL FRAME CARPENTER INTERMEDIATE (SKILLED-LEVEL)

PERFORMANCE TEST

EXAMINEE (print): _____

EXAMINER (signature): _____

SITE COORDINATOR (signature): _____

PROGRAM DIRECTOR (signature): _____

DATE: _____

RESULTS (CHECK ONE):

PART I:	FLOOR JOIST LAY OUT.....	☐ PASS	☐ FAIL
PART IIA:	WALL LAY OUT	☐ PASS	☐ FAIL
PART IIB:	WALL ASSEMBLY.....	☐ PASS	☐ FAIL
PART III:	COMMON RAFTER LAY OUT, CUTTING, & FITTING.....	☐ PASS	☐ FAIL
PART IV:	WINDOW INSTALLATION.....	☐ PASS	☐ FAIL

TABLE OF CONTENTS

SECTION	TITLE	PAGE
I:	FLOOR JOIST LAY OUT	1-1
IIA:	WALL LAY OUT	2-1
IIB:	WALL ASSEMBLY	2-3
III:	COMMON RAFTER LAY OUT, CUTTING, & FITTING	3-1
IV:	WINDOW INSTALLATION	4-1

PRELIMINARY CHECKLIST

TASK:

Lay out floor framing detail on sill or cap plate

RESOURCES:

	Yes	No
Blueprints	☐	☐
Standard tool kit	☐	☐
Sill plate (installed)	☐	☐
Beam/girder (if required, installed)	☐	☐

Note: See specific requirements for each resource in the "Administrative Instructions" booklet.

CONDITIONS:

		Yes	No
1.	Reasonable temperature (40 to 90 degrees Fahrenheit).	☐	☐
2.	Dry job site.	☐	☐
3.	Sill plate conforms to standards.	☐	☐
4.	Beam/girder conforms to standards.	☐	☐

Note: See specific requirements for each condition in the "Administrative Instructions" booklet.

TIME LIMITATION:

Joist spacing	Constant (Worker minutes per linear foot)
12" O.C.	.57
16" O.C.	.43
24" O.C.	.29

1. *Record the length of sill plate that is to be laid out (round to nearest foot).* ..... _____
2. *From the table provided above, select the constant that matches the joist spacing specified on the blueprints.* ..... x _____
3. *Multiply the sill plate length by the constant to determine the time limit (in minutes).* ..... = _____

Time Limit

SEQUENCE KEY:

(S) ***Important Sequence.*** *This step must be performed prior to the steps that follow it.*

SCORE SHEET

PROCESS EVALUATION:

ACTUAL PERFORMANCE TIME:

		Hour:Minute
1.	*When did the examinee start to perform the task?*	_____:_____
2.	*When did the examinee complete the task?*	_____:_____
3.	*Calculate elapsed time in minutes.*	_____
		Elapsed Time

PERFORMANCE SEQUENCE:

			PASS	FAIL
S	1.	Check blueprints.	☐	☐
	2.	Measure and mark location of floor openings and trimmer joists on sill or cap plate. Mark location of trimmers with an "X".	☐	☐
	3.	Measure and mark location of multiple joists for parallel partitions.	☐	☐
	4.	Measure and mark location of floor joists and tail joists. Mark location of floor joists with an "X" and tail joists with a "T".	☐	☐
	5.	Strike chalk lines 1 1/2" from outside edge of sill plate to mark location of rim/band joist.	☐	☐
	6.	Measure, mark and label header locations at foundation wall openings.	☐	☐

PRODUCT EVALUATION:

		PASS	FAIL
1.	Lay out must provide for joist direction as specified on blueprints.	☐	☐
2.	Lay out must provide for joist spacing as specified on blueprints (+/– 1/16").	☐	☐
3.	Lay out must provide for framing members to be installed at right angles to the sill or cap[plate and parallel to each other.	☐	☐
4.	Floor openings must be laid out accurately (+/– 1/16").	☐	☐
5.	Parallel partitions must be laid out accurately (+/– 1/16").	☐	☐
6.	Header locations must be marked and labeled at all foundation wall openings.	☐	☐
7.	Lay out must provide for minimum waste of building materials (i.e., shift lay out to save lumber).	☐	☐

PERFORMANCE EVALUATION

		PASS	FAIL
1.	*If **Elapsed Time** is less than or equal to **Time Limit**, check **PASS**; otherwise check **FAIL**.*	☐	☐
2.	*If check marks appear in the **PASS** column for all steps in the **Performance Sequence**, check **PASS**; otherwise check **FAIL**.*	☐	☐
3.	*If check marks appear in the **PASS** column for all **Quality Requirements** check **PASS**; otherwise check **FAIL**.*	☐	☐

PRELIMINARY CHECKLIST

TASK:

Lay out walls on floor deck

RESOURCES:

	Yes	No
Blueprints	☐	☐
Standard tool kit	☐	☐
100' Tape measure	☐	☐
Floor deck (installed)	☐	☐

Note: See specific requirements for each resource in the "Administrative Instructions" booklet.

CONDITIONS:

		Yes	No
1.	Reasonable temperature (40 to 90 degrees Fahrenheit)	☐	☐
2.	Dry job site	☐	☐
3.	Floor deck conforms to standards	☐	☐

Note: See specific requirements for each condition in the "Administrative Instructions" booklet.

TIME LIMITATION:

Plate Size	Constant (Worker minutes per linear foot)
2 x 3	.36
2 x 4	.43
2 x 6	.65

1. *Record the length of walls that are to be laid out (round to nearest foot).* _____
2. *From the table provided above, select the constant that matches the plate size specified on the blueprints.* x _____
3. *Multiply the length of walls by the constant to determine the time limit (in minutes).* = _____

Time Limit

SCORE SHEET

PROCESS EVALUATION:

ACTUAL PERFORMANCE TIME:

		Hour:Minute
1.	*When did the examinee start to perform the task?*	_____:_____
2.	*When did the examinee complete the task?*	_____:_____
3.	*Calculate elapsed time in minutes.*	_____
		Elapsed Time

PERFORMANCE SEQUENCE:

		PASS	FAIL
1.	Check floor deck for accuracy, straight, square and level.	☐	☐
2.	Check blueprints for specified nominal width of studs for exterior walls.	☐	☐
3.	Lay out exterior walls on floor deck.	☐	☐
	a. Measure and mark width of sole plate from outside edge of floor deck. Mark both ends of each wall section. Note: Add wall sheathing thickness to measurement in step "3a" if blueprints specify that sheathing must rest on subfloor.		
	b. Snap chalk lines between marks.		
4.	Check blueprints for specified nominal width of studs for partitions.	☐	☐
5.	Lay out partitions on floor deck.	☐	☐
	a. Check blueprints for location of partitions.		
	b. Measure and mark location of partitions on floor deck. Mark both ends of each partition.		
	c. Snap chalk lines between marks.		

SEQUENCE KEY:

(S) ***Important Sequence.*** *This step must be performed prior to the steps that follow it.*

PRODUCT EVALUATION:

		PASS	FAIL
1.	Wall and partition locations must be laid out accurately according to blueprint dimensions (+/- 1/16").	☐	☐
2.	Intersections of chalk lines must be square, if applicable.	☐	☐
3.	Lay out must match plate/stud nominal size specified on blueprints.	☐	☐

PERFORMANCE EVALUATION

		PASS	FAIL
1.	*If* **Elapsed Time** *is less than or equal to* **Time Limit,** *check* **PASS;** *otherwise check* **FAIL.**	☐	☐
2.	*If check marks appear in the* **PASS** *column for all steps in the* **Performance Sequence**, *check* **PASS;** *otherwise check* **FAIL.**	☐	☐
3.	*If check marks appear in the* **PASS** *column for all* **Quality Requirements** *check* **PASS;** *otherwise check* **FAIL.**	☐	☐

PRELIMINARY CHECKLIST

TASK:

Assemble wall section

RESOURCES:

	Yes	No
Standard tool kit	☐	☐
Wall plates (w/ framing lay out completed)	☐	☐
Door & window opening assemblies (framed)	☐	☐
Studs (cut to size)	☐	☐
Cripples (cut to size)	☐	☐
Corner & tee posts (assembled)	☐	☐
Hardware	☐	☐

Note: See specific requirements for each resource in the "Administrative Instructions" booklet.

CONDITIONS:

		Yes	No
1.	Reasonable temperature (40 to 90 degrees Fahrenheit)	☐	☐
2.	Dry job site	☐	☐
3.	Framing members conform to standards (see Tasks B.02, B.04 & B.05)	☐	☐
4.	Door and window opening assemblies conform to standards (see Tasks B.07 & B.08)	☐	☐
5.	Framing lay out conforms to standards (see Task B.03)	☐	☐
6.	Building materials are easily accessible and no more than 50' from building foundation	☐	☐

Note: See specific requirements for each condition in the "Administrative Instructions" booklet.

TIME LIMITATION:

Studs @ 12" O.C.	Constant (Worker minutes per linear foot of wall)
2 x 3	1.00
2 x 4	1.33
2 x 6	1.66
Studs @ 16" O.C.	
2 x 3	.75
2 x 4	1.00
2 x 6	1.25
Studs @ 24" O.C.	
2 x 3	.50
2 x 4	.66
2 x 6	.83

1. *Record the length of the wall that is to be assembled (round to nearest foot).* _____
2. *From the table provided above, select the constant that matches the stud spacing and nominal size of framing members.* x _____
3. *Multiply the length of the wall by the constant to determine the time limit (in minutes).* = _____

Time Limit

SCORE SHEET

PROCESS EVALUATION:

ACTUAL PERFORMANCE TIME:

		Hour:Minute
1.	*When did the examinee start to perform the task?*	_____:_____
2.	*When did the examinee complete the task?*	_____:_____
3.	*Calculate elapsed time in minutes.*	_____
		Elapsed Time

PERFORMANCE SEQUENCE:

		PASS	FAIL
1.	Place sole plate near its corresponding chalk line on floor deck.	☐	☐
2.	Place top plate a stud's length from - and parallel to - sole plate.	☐	☐
3.	Turn wall plates on edge with corresponding lay out marks aligned.	☐	☐
4.	Position appropriate door and window opening assemblies on floor deck between wall plates.	☐	☐
5.	Crown and spread studs, corner posts and tee posts on floor deck between sole and top plates.	☐	☐
6.	Position and nail framing members to top plate.	☐	☐
7.	Position and nail framing members to sole plate.	☐	☐
8.	Position and nail cripples as required.	☐	☐

SEQUENCE KEY:

(S) ***Important Sequence.*** *This step must be performed prior to the steps that follow it.*

PRODUCT EVALUATION:

		PASS	FAIL
1.	Framing members must be accurately positioned on lay out marks (+/- 1/16").	☐	☐
2.	Crowns of studs must face same direction.	☐	☐
3.	Door and window openings must be located as specified on blueprints (+/- 1/8").	☐	☐
4.	Cripple placement must be consistent with regular stud placement.	☐	☐
5.	Proper nailing pattern.	☐	☐
6.	No protruding nails.	☐	☐

PERFORMANCE EVALUATION

		PASS	FAIL
1.	*If* **Elapsed Time** *is less than or equal to* **Time Limit,** *check* **PASS;** *otherwise check* **FAIL.**	☐	☐
2.	*If check marks appear in the* **PASS** *column for all steps in the* **Performance Sequence**, *check* **PASS;** *otherwise check* **FAIL.**	☐	☐
3.	*If* ***all*** *check marks appear in the* **PASS** *column of the* **Quality Requirements** *check* **PASS;** *otherwise check* **FAIL.**	☐	☐

PRELIMINARY CHECKLIST

TASK:

Lay out common rafters

RESOURCES:

	Yes	No
Blueprints	☐	☐
Standard tool kit	☐	☐
Standard power tools	☐	☐
Saw horses (2)	☐	☐
Framing lumber	☐	☐

Note: See specific requirements for each resource in the "Administrative Instructions" booklet.

CONDITIONS:

		Yes	No
1.	Reasonable temperature (40 to 90 degrees Fahrenheit).	☐	☐
2.	Dry job site.	☐	☐
3.	Standard or better lumber.	☐	☐
4.	Roof specifications provide on blueprints include:		
	a. pitch	☐	☐
	b. overhang dimensions	☐	☐
	c. nominal size of rafters	☐	☐
	d. building span	☐	☐
5.	Building materials are easily accessible and no more than 50' from building foundation.	☐	☐

Note: See specific requirements for each condition in the "Administrative Instructions" booklet.

TIME LIMITATION:

Rafter nominal size	Constant (Worker minutes per rafter pair)
2 x 4	23.04
2 x 6	24.58
2 x 8	26.11
2 x 10	38.40
2 x 12	43.01

1. *Record the nominal size of the rafters as specified on the blueprints.* ..... _____
2. *From the table provided above, select the constant that matches the rafter nominal size.* ..... _____

Time Limit

SCORE SHEET

PROCESS EVALUATION:

ACTUAL PERFORMANCE TIME:

		Hour:Minute
1.	*When did the examinee start to perform the task?*	_____:_____
2.	*When did the examinee complete the task?*	_____:_____
3.	*Calculate elapsed time in minutes.*	_____
		Elapsed Time

PERFORMANCE SEQUENCE:

			PASS	FAIL
S	1.	Check blueprints.	☐	☐
	2.	Select and mark crown of framing lumber for common rafters.	☐	☐
	3.	Position first piece of lumber on sawhorses.	☐	☐
	4.	Mark ridge plumb cut about 2" from end of board (if there is 2" of material to spare).	☐	☐
	5.	Measure and mark required body length of rafter.	☐	☐
	6.	Subtract one half of thickness of ridgeboard from common rafter theoretical length measured perpendicular to ridge plumb cut.	☐	☐
	7.	Mark heel plumb cut.	☐	☐
	8.	Measure and mark bird's mouth.	☐	☐
	9.	Measure and mark required length of rafter tail.	☐	☐
	10.	Mark tail plumb cut, if applicable.	☐	☐
	11.	Mark tail level cut, if applicable.	☐	☐
	12.	Cut first rafter on lay out marks.	☐	☐
	13.	Label first rafter "PATTERN".	☐	☐
	14.	Trace pattern on second piece of lumber and cut.	☐	☐
	15.	Check fit of rafter pair at ridge, cap plate and rafter tail. Trim as needed.	☐	☐

SEQUENCE KEY:

(S) ***Important Sequence.*** *This step must be performed prior to the steps that follow it.*

PART III: COMMON RAFTER LAY OUT, CUTTING AND FITTING

PRODUCT EVALUATION:

		PASS	FAIL
1.	Rafter nominal size must be as specified on blueprints.	☐	☐
2.	Rafter lay out must be accurate (+/- 1/16").	☐	☐
3.	Ridge plumb cut lines must provide for proper fit at ridgeboard.	☐	☐
4.	Tail cut lines must provide for specified angle of fascia (if applicable).	☐	☐
5.	Bird's mouth lay out must provide for proper fit at cap plate.	☐	☐
6.	At least two-thirds of rafter width must be left above bird's mouth.	☐	☐
7.	Rafter tail lay out must provide for roof overhang as specified on blueprints (+/- 1/16").	☐	☐
8.	Rafter lay out must provide for roof pitch as specified on blueprints.	☐	☐
9.	Rafters must be laid out with crown side up.	☐	☐
10.	Minimum waste of building materials.	☐	☐

PERFORMANCE EVALUATION

		PASS	FAIL
1.	*If* **Elapsed Time** *is less than or equal to* **Time Limit,** *check* **PASS**, *otherwise check* **FAIL**.	☐	☐
2.	*If check marks appear in the* **PASS** *column for all steps in the* **Performance Sequence**, *check* **PASS**; *otherwise check* **FAIL**.	☐	☐
3.	*If check marks appear in the* **PASS** *column for all* **Quality Requirements** *check* **PASS**; *otherwise check* **FAIL**.	☐	☐

PRELIMINARY CHECKLIST

TASK:

Install prehung window

RESOURCES:

	Yes	No
Blueprints	☐	☐
Standard tool kit	☐	☐
Wall section w/ rough opening (installed)	☐	☐
Window unit	☐	☐
Manufacturer's installation instructions	☐	☐
Shims	☐	☐
Hardware	☐	☐

Note: See specific requirements for each resource in the "Administrative Instructions" booklet.

CONDITIONS:

		Yes	No
1.	Reasonable temperature (40 to 90 degrees Fahrenheit)	☐	☐
2.	Dry job site	☐	☐
3.	Builder's quality or better window unit	☐	☐
4.	Wall section and rough opening conform to standards	☐	☐
5.	Building materials are easily accessible and no more than 50' from building foundation	☐	☐

Note: See specific requirements for each condition in the "Administrative Instructions" booklet.

TIME LIMITATION:

* Data are for solid wood, solid plastic, plastic clad and metal clad window units.

Window type and area	Worker minutes each window unit	Window type and area	Worker minutes each window unit
Double-hung		**Bow and bay (awning and casement)**	
0.0 to 10.9 s.f.	30.00	0.0 to 34.9 s.f.	60.00
11.0 to 14.9 s.f.	35.00	35.0 to 49.9 s.f.	70.00
15.0 to 18.9 s.f.	40.00	50.0 to 64.9 s.f.	80.00
19.0 to 22.9 s.f.	45.00	65.0 to 79.9 s.f.	90.00
Casement, awning and hopper		**Bow and bay (double-hung)**	
0.0 to 6.9 s.f.	30.00	0.0 to 29.9 s.f.	60.00
7.0 to 9.9 s.f.	35.00	30.0 to 36.9 s.f.	70.00
10.0 to 12.9 s.f.	40.00	37.0 to 43.9 s.f.	80.00
13.0 to 15.9 s.f.	45.00	44.0 to 50.9 s.f.	90.00
Horizontal sliding			
0.0 to 9.9 s.f.	30.00		
10.0 to 19.9 s.f.	35.00		
20.0 to 29.9 s.f.	40.00		

1. *Measure and record the area of the window opening.* ..... _____
2. *From the table provided above, record the constant that matches the window type and area of the window opening.* ..... _____

Time Limit

SCORE SHEET

PROCESS EVALUATION:

ACTUAL PERFORMANCE TIME:

		Hour:Minute
1.	*When did the examinee start to perform the task?*	____:____
2.	*When did the examinee complete the task?*	____:____
3.	*Calculate elapsed time in minutes.*	_____
		Elapsed Time

PERFORMANCE SEQUENCE:

		PASS	FAIL
1.	Check blueprints for specified window dimensions.	☐	☐
2.	Remove window unit packaging and check for damage.	☐	☐
3.	Measure window unit and rough opening.	☐	☐
4.	Read manufacturer's installation instructions.	☐	☐
5.	Install moisture barrier, if required.	☐	☐
6.	Lift window unit into position.	☐	☐
7.	Position, level, and shim window sill in rough opening.	☐	☐
8.	Tack window flange or exterior casing to wall framing at bottom of window.	☐	☐
9.	Adjust window unit for square, level and plumb.	☐	☐
10.	Nail window flange or exterior casing to wall framing.	☐	☐
11.	Adjust, shim and fasten interior side of window frame to wall framing.	☐	☐
12.	Check window operation and make final adjustments.	☐	☐
13.	Install drip cap, if required.	☐	☐

SEQUENCE KEY:

(S) ***Important Sequence.*** *This step must be performed prior to the steps that follow it.*

PRODUCT EVALUATION:

		PASS	FAIL
1.	Window frame must be square, plumb and level.	☐	☐
2.	Window frame must be fastened to wall framing according to manufacturer's installation instructions.	☐	☐
3.	Window must open without binding.	☐	☐
4.	Consistent gap between window sash and frame.	☐	☐
5.	Head jambs (frames) must be aligned (if applicable).	☐	☐

PERFORMANCE EVALUATION

		PASS	FAIL
1.	*If* **Elapsed Time** *is less than or equal to* **Time Limit,** *check* **PASS**; *otherwise check* **FAIL.**	☐	☐
2.	*If check marks appear in the* **PASS** *column for all steps in the* **Performance Sequence,** *check* **PASS**; *otherwise check* **FAIL.**	☐	☐
3.	*If* ***all*** *check marks appear in the* **PASS** *column of the* **Quality Requirements** *check* **PASS**; *otherwise check* **FAIL.**	☐	☐